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Cooperative Tests of Sweetpotato Varieties, Introductions, and Seedlings for Starch Production and Market Purposes

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The United States Department of Agriculture, Bureau of Plant Industry and Bureau of Agricultural Chemistry and Engineering, in cooperation with the Mississippi Agricultural Experiment Station, the Virginia Truck Experiment Station, and the South Carolina Agricultural Experiment Station

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INTRODUCTION

The sweetpotato (*Ipomoea batatas* (L.) Lam.) is a very important crop in the United States, its farm value exceeding $50,000,000 annually. Approximately 900,000 acres in this country are devoted to its culture.

Hundreds of millions of pounds of root starches have been imported annually from the East Indies. Since these supplies have been cut off by the war, domestic sources of such starches must be developed. Within recent years the utilization of sweetpotatoes as a commercial source of starch has been studied intensively (*11, 12*).[3] Sweetpotato starch has been found equal to, and in some cases superior to, other root starches in the manufacture of certain adhesives, laundry starch of high quality, textile and paper sizings, cosmetics, and for use in the baking and confectionery industries. A variety to be well adapted for starch production should possess a high yielding capacity, a high starch content, and certain physical characteristics that make recovery of the starch commercially feasible. The present varieties adapted to market purposes are either relatively low or only average in their starch contents. Varieties adapted especially for starch production are needed.

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[1] Died April 1, 1941.

[2] Acknowledgment is made to the following present and former members of the Division of Fruit and Vegetable Crops and Diseases: To J. M. Lutz, for making the 1937 and 1938 starch analyses at Meridian, Miss.; to Allan R. Eberle, for making the 1939 starch analyses at Beltsville, Md., and assisting with some of the statistical analyses; to David J. Humphrey, for making most of the root photographs shown in plates 2, 3, 5, and 6; to A. C. Gossard and Belton Walters, for making the remaining root photographs; and to J. H. Beattie and V. R. Boswell for assistance in organizing the experiments and analyzing the results.

Although numerous varieties of sweetpotatoes are under cultivation in the United States, only a small number are of commercial importance. Most of these commercially important market varieties, although of good quality, are more or less variable as to root shape and yields of marketable potatoes, even among plants in a single planting, and are very susceptible to certain serious diseases such as stem rot caused by *Fusarium oxysporum* f. *batatas* (Wr.) Snyder and Hansen. New varieties possessing good quality and at the same time disease resistance and more uniform root shape and yield are therefore highly desirable.

In seeking superior sweetpotatoes for either starch or market purposes several avenues are open. They are (1) introduction of native or improved varieties from foreign countries, (2) picking out natural mutations from commonly grown or introduced varieties, and (3) obtaining new sorts from seed obtained by natural or controlled pollination.

For several years the Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture, has been obtaining and testing considerable numbers of sweetpotato varieties from foreign sources. Among these a few have already been reported by Beattie (*2*) as showing some promise in certain parts of the United States. Numerous others have been, or now are, under test by the Bureau of Plant Industry and various cooperating State stations. Canning and drying tests on a large number of American and introduced varieties have been reported, respectively, by Magoon and Culpepper (*7*) and by Caldwell, Moon, and Culpepper (*3*).

Many present-day sweetpotato varieties are thought to have originated as mutations (*13*), which occur rather frequently in the sweetpotato. The number of new superior varieties likely to be obtained in the short space of a few years by conscious selection of mutants is, however, relatively small, because most of the mutations are undesirable.

Controlled plant breeding only recently has been employed on an extensive scale for the development of new sweetpotato varieties. The method has not been used extensively in the continental United States mainly because of the failure of the sweetpotato plant to flower or to set seed over most of the sweetpotato-producing area. Sweetpotato seed has been produced, within recent years, under tropical or semitropical field conditions by workers cooperating with the Division of Fruit and Vegetable Crops and Diseases.[4] In Louisiana,

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[3] Italic numbers in parentheses refer to Literature Cited, p. 40.

[4] W. K. Bailey, of the Puerto Rico Federal Experiment Station, P. A. Sánches Díaz and others, of the Estación Experimental Agronomíco of Cuba, and J. H. Beaumont, Director of the Hawaii Agricultural Experiment Station.

Miller (*9, 10*) has recently developed methods of seed production from controlled pollinations that make controlled sweetpotato breeding altogether feasible and practicable in certain of the Southern States under both field and greenhouse conditions.

An extensive new cooperative program of sweetpotato breeding and research on culture and propagation was initiated in 1940 by the Bureau of Plant Industry and seven State experiment stations.[5] In view of the new importance of the sweetpotato as a source of starch a summary of the cooperative work done prior to the development of the new program is presented in this circular. Results are given on the yielding capacity, starch content, and other properties of a considerable number of domestic and introduced varieties and new seedlings (herein frequently collectively called sorts) tested during the 6-year period from 1934 to 1939.

PLAN OF THE STUDIES

In 1934 cooperative arrangements were made between the Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, and the Agricultural Chemical Research Division, Bureau of Agricultural Chemistry and Engineering (formerly the Carbohydrate Research Division, Bureau of Chemistry and Soils), for conducting studies relating to sweetpotatoes for starch. Other joint plans included the Mississippi and the South Carolina Agricultural Experiment Stations and the Virginia Truck Experiment Station in studies of varieties, introductions, and seedlings under various conditions of soil, climate, and culture with reference to disease resistance and adaptability for starch manufacture and market purposes.

The investigations were conducted in fairly representative sweetpotato-growing regions; namely, the Middle Atlantic (Beltsville, Md., and Onley, Va.), South Atlantic Coastal Plain (Florence, S. C.), and the Gulf States (Laurel, State College, Meridian, Poplarville, and Stoneville, Miss.). The more extensive yield tests were conducted at the United States Horticultural Station, Beltsville, Md., at the United States Department of Agriculture Horticultural Field Station, Meridian, Miss., and at Laurel and Stoneville, Miss., by the State station. Tests were also conducted at the Pee Dee Experiment Station, Florence, S. C., at the Eastern Shore Experiment Farm of the Virginia Truck Experiment Station, Onley, Va., and at the State College and Poplarville stations of the Mississippi Agricultural Experiment Station.

Most of the starch analyses reported in this circular were made by the Bureau of Agricultural Chemistry and Engineering and by the Mississippi Agricultural Experiment Station. The other phases of the work were conducted by the State experiment stations and the Bureau of Plant Industry.

Starch analyses were made on a large number of varieties grown at Beltsville, Md., and at all the stations in Mississippi, though not at all places in every year.

Tests of stem rot susceptibility were made in the greenhouses at the United States Horticultural Station, Beltsville, Md., in 1936, 1937, and 1939, and tests under field conditions were conducted at Onley, Va., from 1936 to 1939.

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[5] Georgia Experiment Station, Georgia Coastal Plain Experiment Station, Louisiana Agricultural Experiment Station, Mississippi Agricultural Experiment Station, South Carolina Agricultural Experiment Station, Texas Agricultural Experiment Station, and Virginia Truck Experiment Station.

METHODS

Tests in each location were made according to prevailing local methods. Data obtained by each of the cooperating agencies were sent to the United States Horticultural Station, Beltsville, Md., where they were subjected to statistical analysis and prepared for publication.

CULTURE

Ridge culture was used throughout these tests. Hoeing and cultivating were varied in method and frequency according to local requirements. Harvesting was accomplished in some of the tests by hand digging with potato forks and in others by using commercial-type horse-drawn diggers. All grading, weighing, and selection of roots for starch analysis were performed in the field.

At Beltsville, Md., the soil used is classified as Sassafras sandy loam. Fertilizer, applied at the rate of 1,000 pounds per acre, was drilled broadcast after the land was plowed and harrowed and a few days prior to throwing up ridges 4 feet apart. Ridging was always done 10 days to 2 weeks prior to planting. Plants were set approximately 15 inches apart in the rows. Analyses of the fertilizers applied in the several years were as follows: In 1934, 5–10–5;[6] in 1935 and 1936, 5–8–5; in 1937, 5–8–9; and in 1938 and 1939, 0–5–8. Rye was planted after harvest of the crop each fall and turned under the following spring.

At Florence, S. C., plantings were made on Norfolk fine sandy loam in 1936 and 1937 and on Marlboro fine sandy loam, deep phase, in 1938 and 1939. Each year 500 pounds per acre of 3–8–9 fertilizer was applied under the ridges. Plants were spaced 12 inches apart in rows 4 feet apart.

At Onley, Va., the plants were spaced 18 inches apart in rows 2½ feet apart. One thousand pounds per acre of a 3–3–15 fertilizer was applied as a side dressing 2 weeks after planting. There was a heavy natural infestation of the soil with the organism causing stem rot, or wilt, of sweetpotato.

In all the Mississippi trials the fertilizer was applied within the ridges. At Laurel, Miss., applications were made on different soils as follows: In 1935, 800 pounds of 4–8–4 fertilizer on Ruston fine sandy loam; in 1936, 800 pounds of 6–8–4 also on Ruston fine sandy loam; in 1937, 1,000 pounds of 6–8–6 on Cahaba sandy loam; in 1938, 800 pounds of 6–8–4 on Orangeburg sandy loam; and in 1939, 1,000 pounds of 6–8–6 on Kalmia fine sandy loam. Rows were spaced 3 feet apart from 1935 to 1938 and 3½ feet apart in 1939. Plants were set 15 inches apart in the row in 1935, 1937, and 1938, 18 inches apart in 1936, and 12 inches apart in 1939.

At the Delta Branch Station, Stoneville, Miss., 20 pounds of nitrogen per acre derived from ammonium sulfate was applied each year, and plants were set 12 inches apart in 4-foot rows.

The 1939 planting at State College, Miss., was made on a heavy, black, fertile, high-calcium Trinity loam to which 800 pounds per acre of a 6–8–4 fertilizer was applied.

The plantings at Meridian, Miss., were made on a good grade of Norfolk sandy loam, which, because of having been previously planted to soil-depleting crops, was in a rather low state of fertility. Spacing was 12 inches apart in rows 4 feet apart. Fertilizers were applied, half in the ridges of medium height when made up 10 to 14 days before setting the plants and half alongside the rows as side dressings. A 4–10–7 commercial mixture was used; it was applied in 1935 at the rate of 600 pounds per acre and thereafter at the rate of 900 pounds per acre. Ammonium sulfate or its equivalent was applied as a side dressing at the rate of 150 pounds per acre, when the plants had developed short vines or runners. Austrian Winter peas and vetch were planted after the harvest of the crop (except that no soil-building crop followed the harvest of 1937) and were turned into the soil the following spring.

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[6] Five percent nitrogen, 10 percent phosphoric acid, and 5 percent potash.

Table 1 summarizes the salient features of the weather that prevailed at each location for each year of the tests.

TABLE 1.—*Weather conditions prevailing in different years at locations where sweetpotato variety or sort studies were made, expressed with reference to the normal for each location*

Year	Location	Temperature			Rainfall		
		Early	Midseason	Late	Early	Midseason	Late
1934	Beltsville, Md	High	Normal to high	High	Low	Fluctuating low to high	Very high.
1935	do	Normal	High	Low	Slightly low	Low	High.
	Meridian, Miss	Slightly low	do	Normal	Low	do	Low.
	Laurel, Miss	High	do	High	do	High	Do.
1936	Beltsville, Md	Normal	do	do	do	Normal	Do.
	Meridian, Miss	do	Normal	Slightly high	do	High	Do.
	Laurel, Miss	High	do	Variable high to low	do	Normal	Do.
	Florence, S. C	Low	do	High	Slightly high	Low	High.
	Onley, Va	do	do	Normal	Low	do	Do.
1937	Beltsville, Md	High	do	Low	Normal	High	Low.
	Meridian, Miss	Slightly high	Slightly high	Normal	Low	Low	Variable low to high.
	Laurel, Miss	do	Slightly low	Low	Fluctuating low to high	Fluctuating low to high	High.
	Florence, S. C	Normal	Low	do	Slightly low	High	Low.
	Onley, Va	do	Average	do	do	do	Normal.
1938	Beltsville, Md	do	High	do	Low	Normal	High.
	Meridian, Miss	Slightly high	Slightly high	Normal	Variable low to high	Somewhat low	Low.
	Laurel, Miss	Normal	Normal	Slightly low	Low	High	Do.
	Florence, S. C	Low	Low	Low	Slightly high	Somewhat low	High.
	Onley, Va	do	Average	do	High	Fluctuating very high to very low.	Do.
	Stoneville, Miss	Normal	Normal	Normal	Variable low to high	High	Low.
1939	Beltsville, Md	High	Fluctuating low to high	High	Normal	Low	High.
	Laurel, Miss	Slightly low	Slightly low	Normal	High	do	Normal.
	Florence, S. C	Low	Low	High	Low	Slightly high	Low.
	Stoneville, Miss	Slightly low	Normal	Normal	Variable low to high	Low	Do.
	State College, Miss	Normal	Slightly low	High	Slightly high	Variable low to high	Do.
	Poplarville, Miss	do	Normal	do	High	High	Do.
	Onley, Va	Slightly low	Low	Low	do	Slightly high	Do.

Field Plot Arrangements and Statistical Analysis of Data

The test arrangement varied with location and year, but in all cases yield trials consisted of replicated plantings. The same varieties or sorts and tests were not always included at all locations in any single season or for all seasons at any one location, although wherever possible tests were repeated during two or more seasons.

The Beltsville trials were conducted on modified Latin-square designs in most cases with 1- or 2-row 50-foot plots planted in sextuplicate. In certain tests the row lengths were reduced to 40 feet and the number of replications to four.

In all cases, except the 1939 tests at Laurel, the Mississippi trials were conducted on modified Latin-square designs using five replicates of 50-foot single-row plots. In 1939 the work at Laurel was set up on a symmetrical incomplete-block design using six replicates of single-row 25-foot plots.

At Florence, S. C., 2-row 50-foot plots in sextuplicate were arranged as modified Latin squares in all tests.

In the test in 1936 at Onley, Va., 2-row 75-foot plots were grown in quadruplicate.

Data from all modified Latin squares were analyzed as randomized blocks, thus introducing some possible bias, but the error is not considered serious from a practical standpoint in evaluating the data. All yield and starch data were analyzed by Fisher's method (*4*) for the analysis of variance. Snedecor's (*14*) tables of F values were used in interpreting the significance of variance differences. As far as possible data were analyzed for the various tests and locations separately. Although such analyses gave an accurate picture of how certain varieties performed in certain tests and in given locations, they did not individually indicate what the performance of these same varieties was over a wider range of growing conditions.

Information of wider applicability should be obtained where data from tests conducted in widely separated locations or in different years can be included in a combined data analysis. In the present tests, owing to inconsistencies in the experimental set-ups within and among locations, it was impossible to set up a single analysis that would include all tests. Instead, numerous smaller tables were developed, each covering certain varieties in one or more years at a single or several locations. The procedure adopted allowed valid use of the variance method without introducing disproportionate frequencies. It is realized that combining results of tests not conducted in an entirely uniform manner prevented the determination of certain sources of variation, but at the same time it permitted valuable comparisons of many more sorts tested in different years and places than would otherwise be possible. Superior or inferior sorts in a combined analysis of data for two or more locations or tests were usually found correspondingly superior or inferior for any single location or test, indicating that reasonable confidence could be placed in the relative values found for the several varieties tested. A number of tables giving summaries of representative comprehensive tests, together with certain of the accompanying statistical analyses, are presented in this circular. Presentation of all the tables of data and statistical analyses is neither practicable nor necessary.

Starch Sampling and Analysis

Sampling for starch was effected by cutting out representative V-shaped longitudinal sections from 10 to 20 typical roots of each lot selected in the field, by means of a power-driven sugar-beet sampling rasp. Sampling was accomplished within 2 to 4 hours after digging, except in some of the earlier work where roots were sometimes held for a day or two. Roots were quickly washed in cool water and dried with towels before passing them through the rasp. Some of the starch determinations were made on the freshly pulped material, but most were made on samples preserved in alcohol. Determinations of starch content were made by polariscopic methods (*1*),[7] except in 1937 and 1938 at Meridian, Miss., when determinations were made by the difference method (*6*).

VARIETAL OR SORT CHARACTERISTICS

In the studies on which data are reported a number of standard commercially important or better known American varieties were included. In table 2 are presented brief tabular descriptions of the different varieties, including notations on their relative yielding capacity and starch content. More detailed descriptions of certain of these varieties are available in other publications (*5, 8, 15*). Typical leaves and roots of several of them are shown in plates 1 to 3.

Table 2.—*Some characteristics of certain standard or better known American varieties of sweetpotatoes included in the 1934–39 tests*

Variety	Vine	Leaf	
		Shape	Color of blade
Big-Stem Jersey	Moderately large; stems green	Shouldered to entire.	Green.
Florida (white)	Large, vigorous, medium long; stems green.	Toothed to entire	Green except for deep purple stain at base of blade and summit of petiole.
Myers Early	Stems moderately vigorous, green.	Lightly toothed to entire.	Green except for slight purple stain at juncture of blade and petiole.
Nancy Hall	Stems green, medium long	Toothed to entire	Green except for reddish purple stain at juncture of blade and petiole.
Porto Rico	Stems coarse, medium long, reddish purple.	Shouldered	Green except for purple stain in veins and at base of blade.
Red Bermuda	Stems large, vigorous, long, purple.	do	Blade green except for reddish purple stain at base and summit of petiole.
Red Brazil	Long to very long, vigorous, medium coarse, purple.	Shouldered to entire.	Green with deep purple stain at base of blade.
Red Jersey	Long and slender, green	do	Green.
Southern Queen (Hayman).	Large, vigorous, dull purple	do	Do.
Triumph	Coarse, vigorous, short or medium long.	Shouldered	Green with deep purple veins on under side of blade.
Vineland Bush	Short, slender, green; leaves numerous.	Small-shouldered to entire.	Medium green.
Yellow Jersey	Long, slender, green	Shouldered to entire.	Do.
Yellow Strasburg	Large, vigorous, long, purple	Shouldered	Green except purple stain at juncture with petiole.

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[7] Unpublished method developed by R. M. Kingsbury and H. S. Paine, of the Bureau of Agricultural Chemistry and Engineering, U. S. Department of Agriculture.

TABLE 2.—*Some characteristics of certain standard or better known American varieties of sweetpotatoes included in the 1934–39 tests*—Continued

Variety	Roots				
	Shape	Color of skin	Color of flesh		Flesh type
			Raw	Baked	
Big-Stem Jersey	Long fusiform, veined or smooth.	Russet yellow	Yellow	Light yellow or cream.	Very dry.
Florida (white)	Long fusiform, fairly smooth and regular.	White	Light yellow	Yellow	Moist.
Myers Early	Thick fusiform, smooth and fairly regular.	Yellow tinged with salmon.	Dark yellow tinged with salmon.	Dark yellow	Do.
Nancy Hall	Fusiform, smooth and regular.	do	do	do	Do.
Porto Rico	Fusiform to globular or irregular.	Light rose to rose.	Orange yellow to salmon.	do	Do.
Red Bermuda	Irregular, ribbed, short fusiform, globular, or ovoid.	Deep rose or reddish purple.	Light yellow	Dull yellow	Dry.
Red Brazil	Irregular globular or chunky.	Rose	Dark yellow	Dark golden yellow.	Medium dry.
Red Jersey	Fusiform, smooth and regular.	Red	Yellow	Yellow	Very dry.
Southern Queen (Hayman).	Fusiform, globular, or ovoid, smooth.	White or pale yellow.	Light yellow	Dull yellow	Moist.
Triumph	Medium to long cylindrical.	Yellow or russet yellow.	do	Creamy yellow	Medium moist.
Vineland Bush	Regular ovoid to fusiform.	Russet yellow	Yellow	Bright yellow	Very dry.
Yellow Jersey	Fusiform to ovoid	do	do	do	Do.
Yellow Strasburg	Ovoid to globular, fairly smooth.	Light yellow	Dull yellow	Lemon yellow	Medium moist.

Variety	Table quality	Keeping quality	Relative yield	Relative starch content
Big-Stem Jersey	Good	Good	High	Low.
Florida (white)	Fair to good	Excellent	Medium	High.
Myers Early	Excellent	Good	Medium high	Medium.
Nancy Hall	do	do	High	Do.
Porto Rico	do	do	Medium	Do.
Red Bermuda	Fair	Fair to good	High	Medium high.
Red Brazil	Good	Good	do	High.
Red Jersey	Fair to good	Poor	Medium high	Low.
Southern Queen (Hayman).	Good	Good	Medium	Medium high.
Triumph	Fair to good	do	High	High.
Vineland Bush	Good	Fair	Medium	Low.
Yellow Jersey	do	do	do	Do.
Yellow Strasburg	do	Excellent	do	High.

Among the varieties described in table 2, all of which have had more or less popularity as market varieties at some time, Porto Rico and Nancy Hall are outstanding in quality and make up a large proportion of the total quantity of "moist"-fleshed sweetpotatoes now grown in this country for table use. Both of these varieties are highly susceptible to stem rot or wilt. Myers Early is very similar in appearance and properties to Nancy Hall. Northern markets have, in the past, shown a decided preference for the dry-fleshed varieties of the Jersey group. Within recent years, however, there has been an increasing demand in the North for the Porto Rico and Nancy Hall.

In parts of the South, Triumph is grown as a general-purpose sweetpotato. It produces high yields, has fair to good table quality, shows some resistance to wilt, and at present is being grown for starch manufacture.

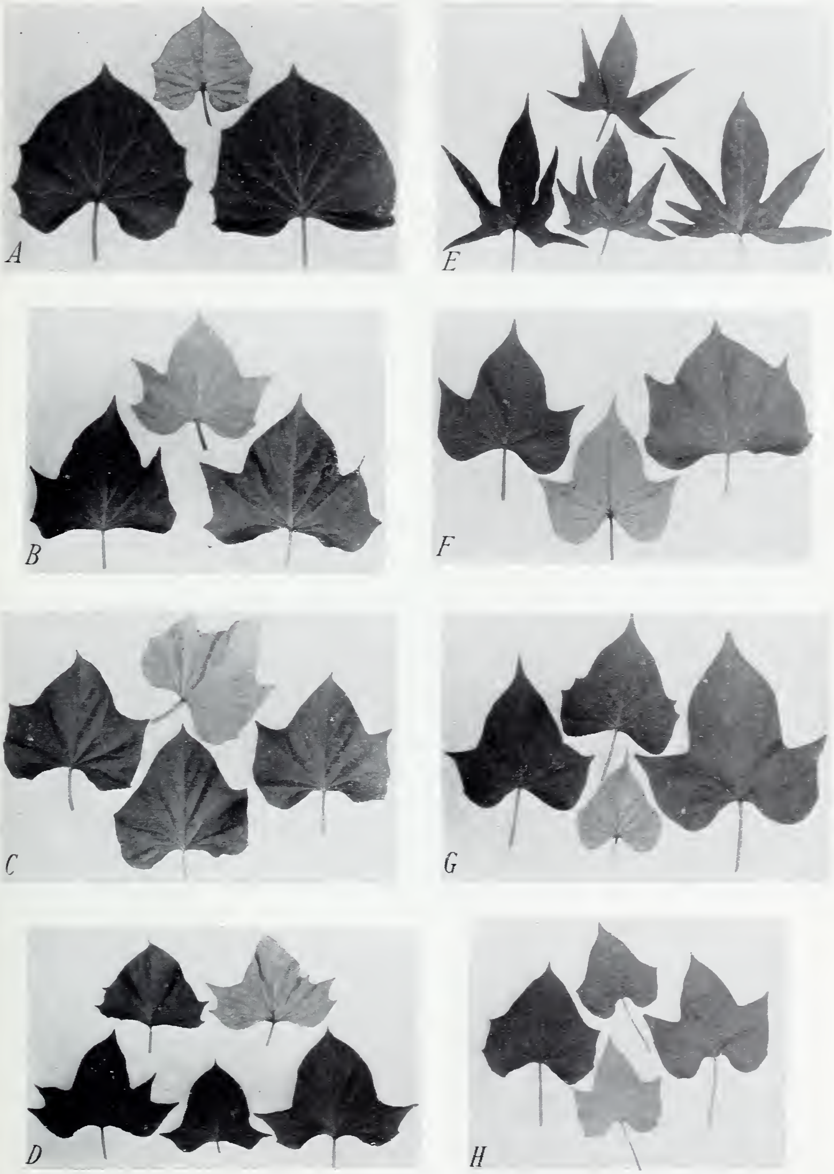
Pending the development of better sorts the varieties Red Bermuda, Red Brazil, Southern Queen (Hayman), and Triumph varieties appear to have possibilities as sources for commercial starch recovery. (See results of starch tests given on pp. 25–36.)

The investigations of Caldwell, Moon, and Culpepper *(3)* and of Magoon and Culpepper (7) indicated that all tested of the varieties described in table 2 were at least fair or better in quality when utilized for drying purposes, and, with the exception of the variety Florida, were also fair or better when used for canning.

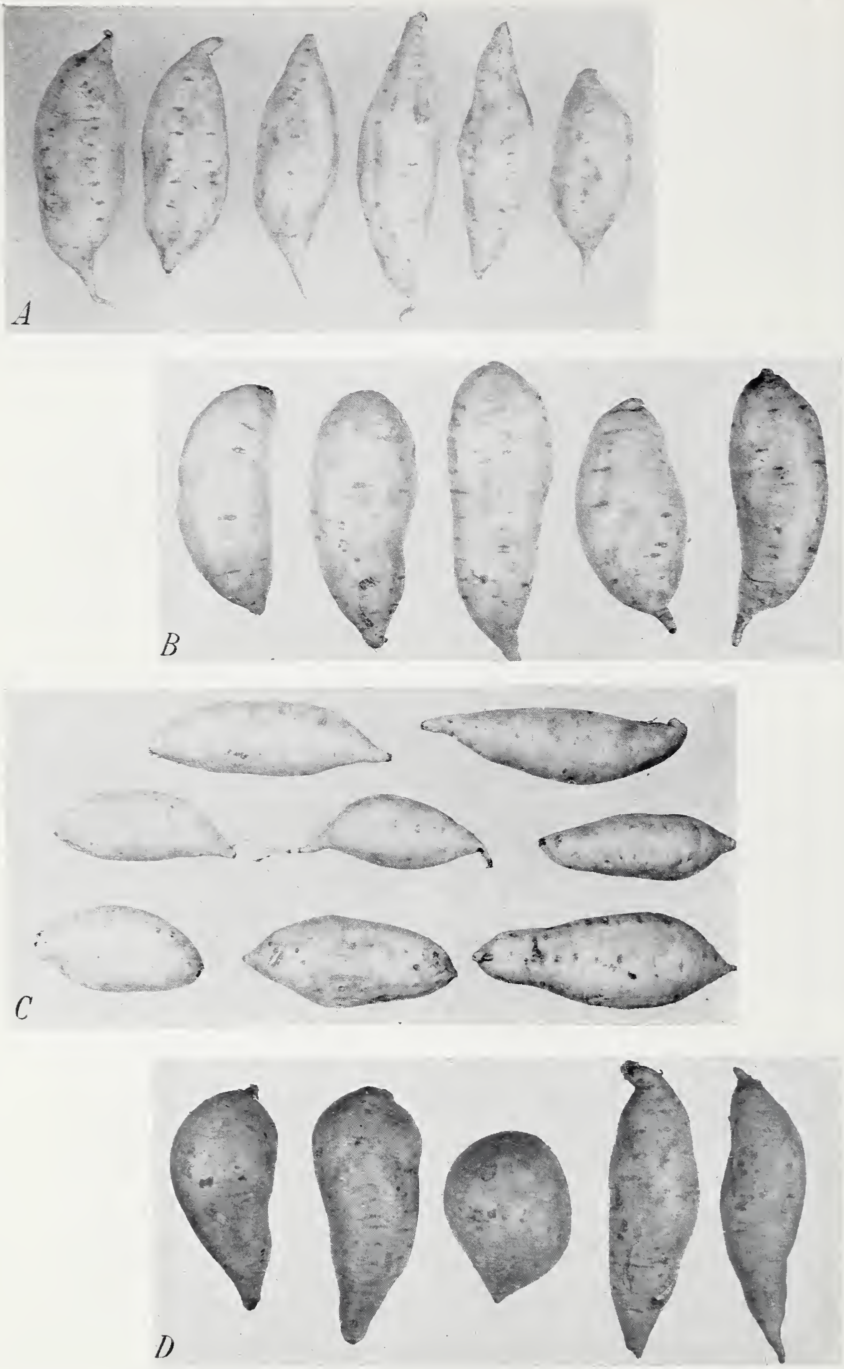
Purple Stem Triumph, a selection from Triumph, is very similar to it in all characteristics except that it has a decided purple pigmentation in the stems and petioles of the plant. Roots of these two varieties are identical in appearance.

Descriptions are presented in table 3 for a number of less known sorts that have shown more or less promise in the tests. Some of these have not been described in this country, and even those that have been described merit having their properties again brought to the attention of the public. Leaf and root shapes of some of these varieties are illustrated in plates 4 to 6.

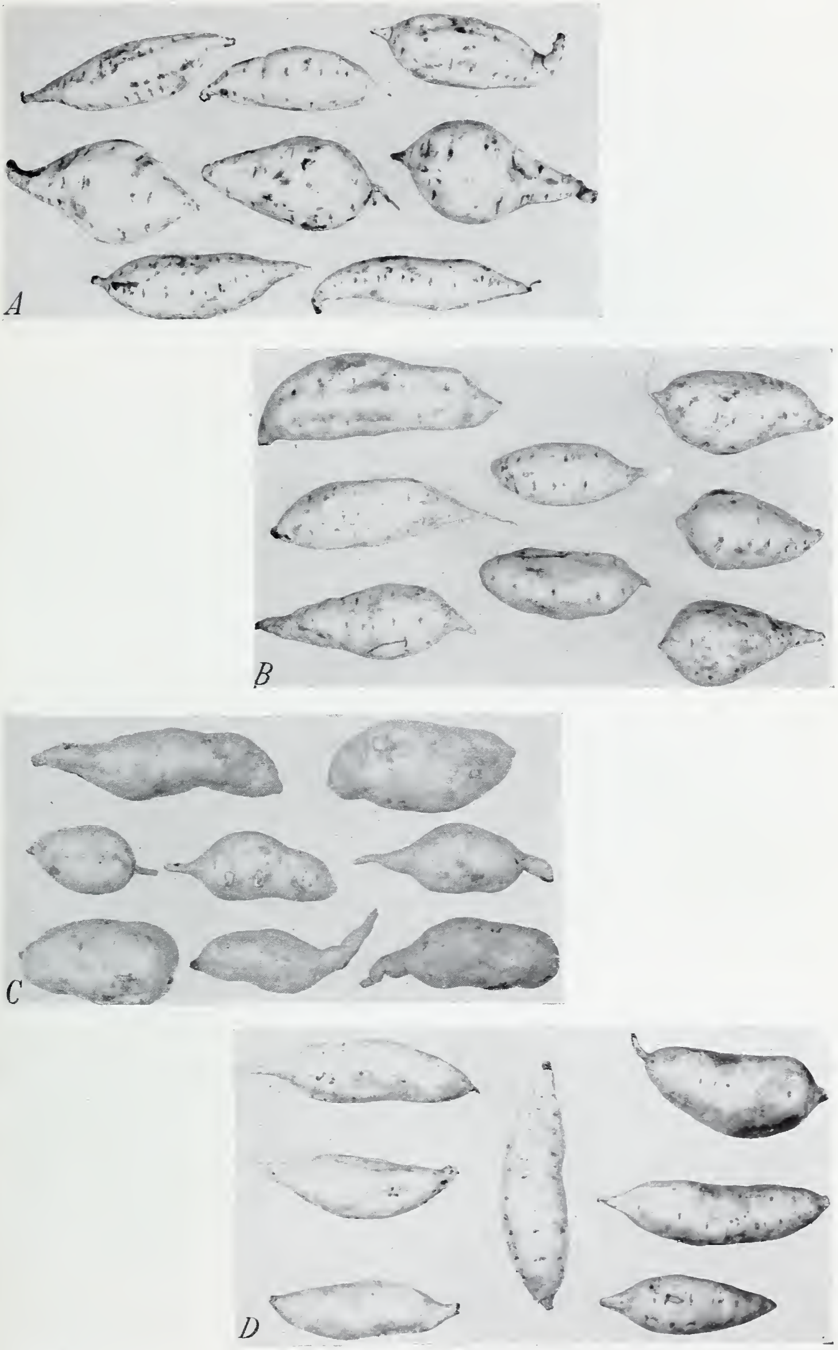
In this group there are several sorts that have good table quality, yield well, and show more or less promise for market. Among these are Mameyita, North Carolina No. 1, Unit I Porto Rico, Pierson, Wenholz 1, Wenholz 2, Japanese Yam, Menes Moeder, Kioranda Dutch Yellow, and Norton. Mameyita, which was obtained from the Puerto Rico Agricultural Experiment Station in 1919, is similar to Porto Rico in both plant and root characteristics. North Carolina No. 1 and Unit I Porto Rico are selections made at the North Carolina and Louisiana Agricultural Experiment Stations, respectively, from the variety Porto Rico. The two Wenholz varieties obtained from the Department of Agriculture, New South Wales, Australia, have produced high yields of fairly uniformly shaped, excellent-keeping roots of good table quality. Japanese Yam and Kioranda Dutch Yellow, introduced from Japan, and Menes Moeder, introduced from Java, are all of the moist type and produce medium to high yields of good to excellent-quality roots. However, both Japanese Yam and Kioranda Dutch Yellow have lighter root and flesh colors than seem desirable for market. The variety Maryland Golden, a selection from Big-Stem Jersey, has unusually rich orange flesh and skin colors but has been only fair in keeping quality.



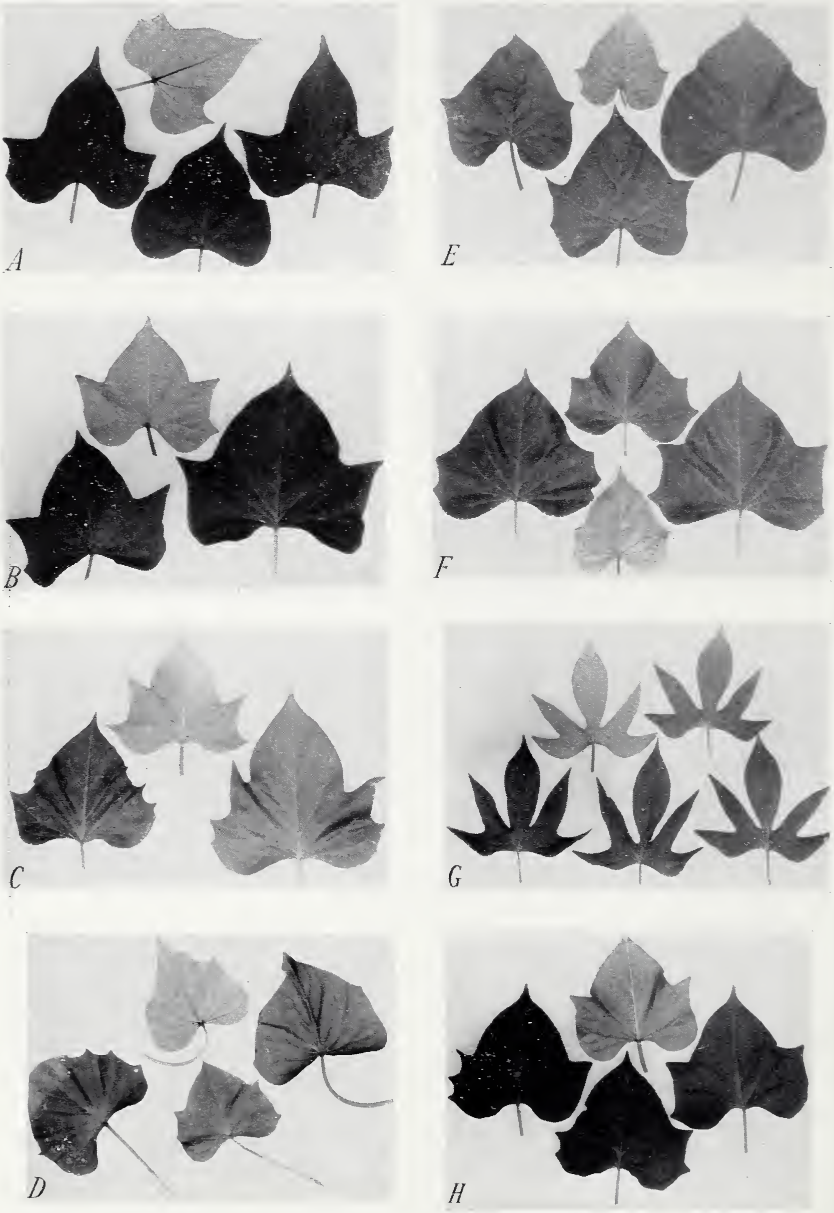
Typical leaves of eight standard or better known varieties of sweetpotato: *A*, Nancy Hall; *B*, Triumph; *C*, Big-Stem Jersey; *D*, Porto Rico; *E*, Southern Queen; *F*, Yellow Strasburg; *G*, Red Brazil; and *H*, Yellow Jersey.



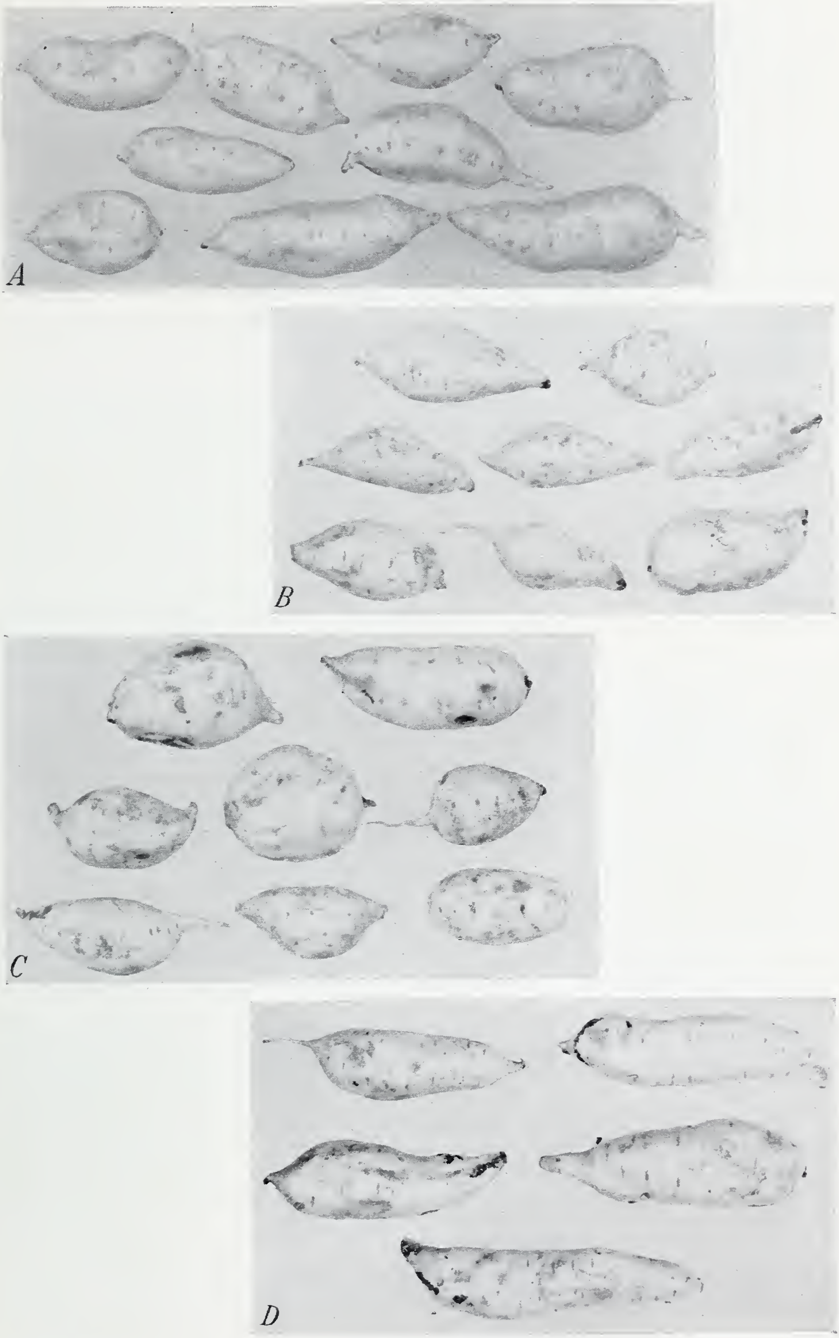
Typical root shapes of four standard varieties of sweetpotato: *A*, Nancy Hall; *B*, Triumph; *C*, Big-Stem Jersey; and *D*, Porto Rico. *A* and *C* grown at Beltsville, Md., and *B* and *D* grown at Meridian, Miss., 1940.



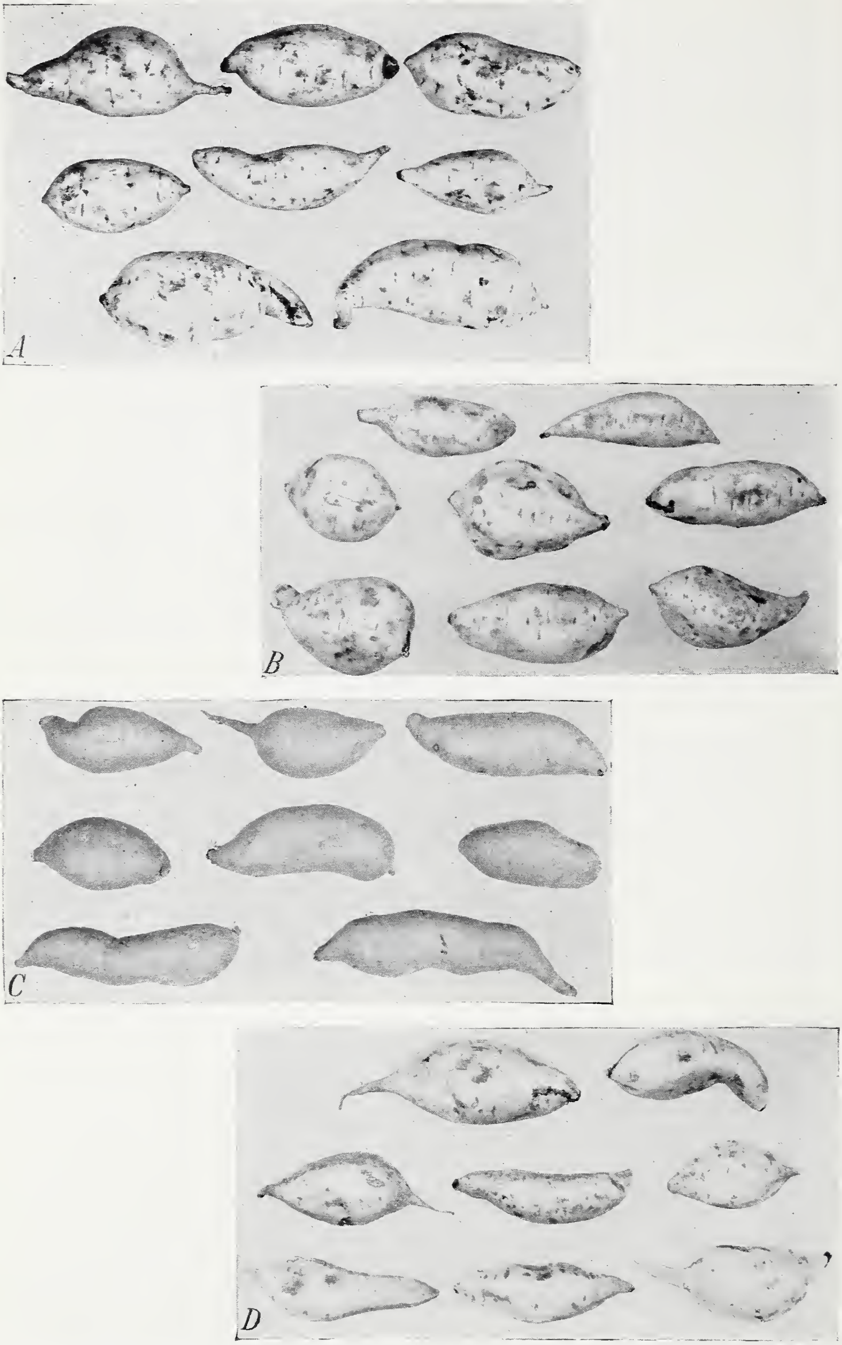
Typical root shapes of four standard or better known varieties of sweetpotato grown at Beltsville, Md., in 1940: *A*, Southern Queen; *B*, Yellow Strasburg; *C*, Red Brazil; and *D*, Yellow Jersey.



Typical leaves of eight less known but promising sorts of sweetpotato: *A*, Pierson; *B*, Norton; *C*, 029878 (introduction); *D*, Director; *E*, Wenholz 2; *F*, Kioranda Dutch Yellow; *G*, B–33 (seedling); and *H*, Wenholz 1.



Typical root shapes of four less known but promising sorts of sweetpotato grown at Beltsville, Md., 1940: *A*, Pierson; *B*, Norton; *C*, 029878 (introduction); and *D*, Director.



Typical root shapes of four less known but promising sorts of sweetpotato grown at Beltsville, Md., 1940: *A*, Wenholz 2; *B*, Kioranda Dutch Yellow; *C*, B–33 (seedling); and *D*, Wenholz 1.

Table 3.—*Characteristics of less known American or introduced varieties or seedlings that have shown more or less promise in the 1934–39 tests*

Variety or seedling	Origin	Vine	Leaf	
			Shape	Color of blade
Big Wig	Virgin Islands	Bunching	Deeply lobed	Dark green.
Black Spanish		Moderately long	Deeply shouldered	Dark green, with veins.
Director		Medium long, vigorous.	Entire cordate to somewhat shouldered.	Dark green, with veins purple beneath.
Japanese Yam (22437).	Japan	Short to medium, coarse.	Large green, toothed to lightly shouldered.	Green.
Kioranda Dutch Yellow (85986).	do	Medium long, coarse.	Shouldered	Dark green.
Mameyita	Puerto Rico	Medium long, coarse, vigorous.	Shouldered, halberd-shaped (like Porto Rico).	Green with veins purple beneath.
Maryland Golden		Moderately large	Shouldered to entire	Green.
Menes Moeder (47442).	Java	Short, coarse, thick	Large-shouldered	Green with purple stain at base of leaf.
North Carolina No. 1.		Medium long, coarse, reddish purple stems.	Shouldered	Green with veins purple beneath.
Norton		Moderately long	Shouldered to entire	Green with or without slight purple tinge.
Oebi Saboelan (64377).	Java	Stocky, coarse, bunching.	Shouldered	Green.
Pierson		Long, vigorous	do	Green with deep purple stain at juncture of blade and petiole.
Question		Long, medium coarse.	Cordate to halberd-shaped, toothed to strongly shouldered.	Medium green with tendency to bronzing.
St. Lucia		Medium short with rather slender veins.	Deeply lobed	Dark green.
Unit I Porto Rico		Stems coarse, medium long, reddish purple.	Shouldered	Green except purple stain in veins and at base of blade.
Wenholz 1	Australia	Medium long, coarse.	Shouldered, cordate	Dark green.
Wenholz 2	do	Long, coarse	Angular to cordate, lightly toothed to shouldered.	Do.
Wennop	do	Medium long, coarse, vigorous.	Shouldered to deeply lobed.	Do.
Yellow Spanish		Moderately large	Deeply shouldered	Dark green with purple veins.
029878	Union of Soviet Socialist Republics.	Medium long, rather coarse, vigorous.	Toothed to shouldered, angular to cordate.	Medium green.
029881	do	do	Shouldered, cordate	Dark green with some purple overcast; midrib and veins purple.
10412		Long, very coarse	Slightly to strongly shouldered.	Dark green; veins purple near juncture with petiole.
B–25	Seedling	Medium long, coarse.	Deeply toothed	Dark green; veins and midrib purple on under side.
B–33	do	Medium long, coarse, vigorous.	Deeply lobed	Dark green.
B–52	do	Long, coarse	Shouldered	Medium green.
S–312		Long, medium coarse.	Slightly toothed to shouldered.	Dark green.

TABLE 3.—*Characteristics of less known American or introduced varieties or seedlings that have shown more or less promise in the 1934–39 tests*—Continued

Variety or seedling	Roots			
	Shape	Color of skin	Color of flesh	
			Raw	Baked
Big Wig	Somewhat crooked, thick spindle or cylindrical.	Purple	White	
Black Spanish	Long fusiform to cylindrical.	Dark red	White or cream	Grayish white.
Director	Thick spindle or cylindrical, smooth.	Light yellow with pink overcast	Light cream	
Japanese Yam (22437).	Thick spindle to globular, smooth.	White or pale yellow	White	White.
Kioranda Dutch Yellow (85986).	Globular to ovoid, smooth	Cream	Ivory	Pale yellow.
Mameyita	Large, broad to ovoid, smooth.	Salmon pink	Deep salmon	Deep orange.
Maryland Golden	Short, thick, fusiform	Orange yellow	Rich orange	Do.
Menes Moeder (47442).	Broad, globular, smooth skin.	Orange to salmon	Rich salmon	Do.
North Carolina No. 1.	Thick spindle to globular	Deep salmon pink	Deep salmon	Do.
Norton	Medium large, fusiform to cylindrical.	Faint salmon over light yellow.	Dark yellow	Yellow.
Oebi Saboelan (64377).	Long, cylindrical, smooth	White or light yellow.	Salmon	
Pierson	Cylindrical or ovoid, somewhat irregular.	Light yellow	Cream	Dull yellow.
Question	Short ovoid to chunky, somewhat ridged.	White with faint pink blush.	Mottled salmon on cream.	
St. Lucia	Long cylindrical, rather crooked.	White with slight pink overcast.	Ivory	
Unit I Porto Rico	Fusiform to globular or somewhat irregular.	Light rose to rose	Salmon	Dark yellow.
Wenholz 1	Short, thick spindle to ovoid.	White or very pale yellow.	Deep cream	Lemon yellow.
Wenholz 2	Thick spindle to ovoid	Pale yellow	Cream	Pale yellow.
Wennop	do	White with light-pink blush.	White	White.
Yellow Spanish	Long fusiform or cylindrical, often crooked.	Dull russet yellow	Grayish white	Gray.
029878	Short ovoid to cylindrical	Light yellow	Yellow	Pale yellow.
029881	Chunky ovoid to cylindrical, very rough and ridged.	Buff yellow, slight pink overcast.	do	
10412	Thick-tapered to chunky, rough, crooked.	Rose purple	do	Bright yellow.
B-25	Chunky or short tapered	White with slight pink blush.	White	White.
B-33	Medium thick, spindle to oblong, very smooth.	Rose purple	Ivory	Pale yellow.
B-52	Chunky or cylindrical, smooth.	do	Cream or ivory	
S-312	Somewhat irregular cylindrical.	Pale yellow	do	Pale yellow.

Variety or seedling	Flesh type	Table quality	Keeping quality	Relative yield	Relative starch content	Remarks
Big Wig			Good	Low	Medium to low.	
Black Spanish	Moist	Fair	Fair	Low to medium.		
Director			Excellent	Medium	Medium to high	
Japanese Yam (22437).	Moist	Good	Good	High	Medium	
Kioranda Dutch Yellow (85986).	do	Excellent	Excellent	do	High	
Mameyita	do	do	Good	Medium	Medium	Similar to Porto Rico, but with richer flesh and skin color.
Maryland Golden	Dry	Fair to good.	Fair to poor.	Medium high.	Low	Selection from Big-Stem Jersey; very attractive flesh color.

Table 3.—*Characteristics of less known American or introduced varieties or seedlings that have shown more or less promise in the 1934–39 tests*—Continued

Variety or seedling	Flesh type	Table quality	Keeping quality	Relative yield	Relative starch content	Remarks
Menes Moeder (47442)	Moist	Excellent	Good	Medium	Medium	Resistant to soil rot.
North Carolina No. 1.	do	do	do	Medium to high.	do	Selection from Porto Rico with deeper skin and flesh color.
Norton	do	Good	Excellent	Medium high.	High	
Oebi Saboelan (64377).			do	do	do	
Pierson	Dry to moderately moist.	Good	do	High	Medium high.	
Question			Fair	Medium	Medium	
St. Lucia			do	Low medium.	do	
Unit I Porto Rico	Moist	Excellent	Good	Medium	do	Selection from Porto Rico; flesh and skin color a trifle deeper, and shape slightly more regular than Porto Rico.
Wenholz 1	do	Good	Excellent	High	Low	
Wenholz 2	do	do	do	do	Medium high.	
Wennop	Semimoist	Fair to good.	do	Medium	do	Rather slow sprout producer; excessive producer of latex.
Yellow Spanish	Moist	Fair		Low		
029878	do	do	Fair	Medium	Medium high.	
029881	do		Good	Medium to high.	Medium low.	Unattractive.
10412	Semidry	Fair		Low to medium.	Medium high.	
B-25	Dry	Poor or fair.	Fair	Medium	Medium	Very susceptible to scurf, black rot, and nematode injury.
B-33	Semidry	Fair	Excellent	High	Medium high.	
B-52			Good	Medium to high.	do	
S-312	Moist	Fair	do	Low to medium.	do	

Several sorts described in table 3 have possibilities as starch sources because of fairly high starch contents and good yields. Norton, Pierson, Wennop, 029878, Oebi Saboelan, Kioranda Dutch Yellow, and B–33 are in this group.

The following sorts, not all of which have exhibited outstandingly good market or starch-producing qualities, should have value in sweetpotato-breeding programs because they have shown more or less resistance to or tolerance to the stem rot organism: Big Wig, Wennop, Menes Moeder, Pierson, Red Bermuda, Triumph, 10412, 85985, B–25, and B–33. It should be observed that none of the commercially important varieties of sweetpotatoes grown in the United States for market possesses much resistance to stem rot. (See detailed results of tests for stem rot resistance on pp. 36–39.)

Although about 50 other introductions or seedlings were included in the tests, most of them have been of mediocre or inferior quality in one or more respects and do not merit consideration here. A few lots included in this category have shown some tolerance to the stem rot disease and for this reason are being utilized in the plant-breeding program. Among them are 36, 127, 254 and 291, all open-pollinated seedlings of Big Wig, and 194, an open-pollinated Black Rock seedling, all obtained from the Virgin Islands Experiment Station.

YIELDS

The number of varieties or sorts in a single test varied among the years, depending upon receipts of new stocks and the availability of material for observation. The number of replicates and of times each was grown also varied as a result of the rapidly changing collection of material that was being built up. Miscellaneous data of this kind are admittedly awkward to present, and many desirable sort comparisons must be made less accurately than may be desired. Nevertheless, variance analyses were carried through upon numerous groups of sorts that could be compared for one to several years or locations.

In the interest of brevity the details of only a few of the numerous variance analyses are presented, but in each table reference is made to the magnitude of differences required for significance between sorts. Significant variances occurred for sorts and replicates in every test but one. In most group tests involving more than 1 year there were significant variances due to years and interactions between sorts and years. Sort variances, in all but one comparison, were significantly greater than interaction variances involving sorts, indicating the existence of fairly consistent superiority of certain sorts despite yearly or place variations.

Tests at Beltsville, Md.

Summarized results of the tests at Beltsville, Md., together with the calculated minimum differences between sort means required for significance, are presented in tables 4 to 7.[8] In order to compare certain of the sorts included in the several Beltsville tests table 8 was prepared; yields for each year were averaged for all tests in which a sort occurred. Since certain sorts occurred in more tests than others the sort means are only roughly comparable even within years, but they do make approximate differences apparent.

In table 4 yield data are presented for 4 tests involving 22 sorts, studied at Beltsville in 1934, 1935, and 1936. The analysis of variance for the combined data of all 4 tests showed significant variances due to sorts, to tests, to replicates, and to the interaction of sorts and tests with reference to "error" variance. The relative performance of the various sorts was not the same in all tests. However, the variance due to sorts was significantly greater than that for the interaction between sorts and tests, showing that in all tests certain sorts were consistently high yielders.

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[8] The magnitude required for significance of differences between sort means is calculated as twice the standard error of a difference based on "error" variance.

Table 4.—*Mean U. S. No. 1 grade and total yields per acre of 22 sweetpotato sorts, Beltsville, Md., 1934–36*

[Means of sextuplicate plots]

Sort	1934		1935–A		1935–B		1936		Mean[1]	
	No. 1	Total	No. 1	Total	No. 1	Total	No. 1	Total	No. 1	Total
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Big-Stem Jersey	140	198	309	435	127	210	94	208	168	263
Florida (white)	152	195	------	------	------	------	------	------	------	------
Japanese Yam (22437)	179	229	247	335	137	223	144	193	177	245
Key West	179	229	139	172	134	199	26	48	120	162
Kioranda Dutch Yellow (85986)	240	306	350	458	129	220	160	213	220	299
Mameyita	155	222	259	340	131	196	86	122	158	220
Menes Moeder (47442)	140	194	231	332	95	164	129	191	149	220
Nancy Hall	230	285	218	296	147	232	124	200	180	253
Oebi Saboelan (64377)	209	258	291	401	152	203	151	205	201	267
Pierson	------	------	------	------	------	------	206	320	------	------
Porto Rico	166	234	269	365	137	215	90	129	166	236
Southern Queen	119	188	233	322	146	215	125	182	156	227
Triumph	126	171	------	------	------	------	------	------	------	------
Vineland Bush	158	226	187	300	102	178	158	233	151	234
Yellow Jersey	139	211	191	344	109	212	97	215	134	246
021745	------	------	------	------	------	------	209	272	------	------
254	159	212	143	204	125	196	------	------	------	------
291	112	166	75	153	61	106	------	------	------	------
312	113	163	101	165	62	120	164	231	110	170
10412	174	213	------	------	------	------	111	158	------	------
47443	------	------	------	------	------	------	186	219	------	------
85985	------	------	------	------	------	------	239	289	------	------
Mean	153	217	216	257	120	193	138	202	133	234
Difference required for significance	45	52	70	83	43	50	38	39	10	29

[1] For 13 sorts in all 4 tests.

Table 5.—*Mean U. S. No. 1 grade and total yields per acre of 23 sweetpotato sorts, Beltsville, Md., 1936–38*

[Means of sextuplicate plots]

Sort	1936		1937		1938	
	No. 1	Total	No. 1	Total	No. 1	Total
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Black Spanish	145	208	73	123	[1] 114	[1] 188
Director	186	266	------	------	100	193
Florida (white)	196	251	114	188	142	262
Kioranda Dutch Yellow (85986)	------	------	80	139	------	------
Mameyita	------	------	74	108	115	182
Myers Early	184	241	126	181	[1] 152	[1] 216
Nancy Hall	192	245	106	162	[1] 160	[1] 229
Norton	197	262	97	154	[1] 127	[1] 268
Porto Rico	172	211	62	102	126	220
Red Bermuda	287	390	192	317	150	310
Red Brazil	302	358	107	172	115	260
St. Lucia	156	216	------	------	------	------
Vineland Bush (test 1)	------	------	145	224	119	202
Vineland Bush (test 2)	------	------	141	217	------	------
Wenholz 2	240	234	96	175	[1] 156	[1] 311
Wennop	199	267	------	------	160	306
Yellow Jersey	------	------	114	215	71	139
Yellow Strasburg	209	292	75	129	130	222
254	163	208	------	------	------	------
312	------	------	44	100	------	------
24171	184	274	139	220	129	230
85984	335	383	73	139	93	178
85991	352	402	------	------	------	------
97359	124	159	------	------	------	------
Mean	212	275	103	170	121	225
Difference required for significance	53	46	28	42	24	48

[1] Figure given is for four replicates only; two late replicates were omitted from the analysis of data.

TABLE 6.—*Mean U. S. No. 1 grade and total yields per acre of 28 sweetpotato sorts, Beltsville, Md., 1937 and 1938*

[Means of quadruplicate plots]

Sort	1937		1938 (total)
	No. 1	Total	
	Bushels	*Bushels*	*Bushels*
Formosa Seedling (1934)			213
Porto Rico	62	97	286
Question			158
Triumph			194
Vineland Bush	111	197	254
Virovsky			293
Yellow Jersey			152
254	68	87	
10412	26	62	
47444	25	36	
029881	160	210	
B-1	139	193	
B-6	100	157	
B-8	123	197	287
B-10	74	119	82
B-18	147	250	185
B-22	95	126	211
B-24	88	147	133
B-27			187
B-30	68	108	
B-33	198	339	211
B-38	114	185	199
B-51	91	129	129
B-52	62	98	
B-65			179
B-69			135
B-70			181
B-73			168
Mean	97	152	192
Difference required for significance	48	65	40

TABLE 7.—*Mean U. S. No. 1 grade and total yields per acre of 21 sweetpotato sorts, Beltsville, Md., 1937 and 1938*

[Means of sextuplicate plots]

Sort	1937		1938		Mean [1]	
	No. 1	Total	No. 1	Total	No. 1	Total
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Big-Stem Jersey			195	305		
Big Wig	42	74	53	95	48	85
Black Rock	116	176	167	259	142	218
Menes Moeder (47442)	87	154	136	256	112	205
Nancy Hall	155	208	210	317	183	263
N. Y. B. G.-1	40	73	60	92	50	83
Pierson	207	365	170	447	189	406
Porto Rico	148	229	142	301	145	265
Triumph			115	189		
Vineland Bush	92	138	162	220	127	179
Wenholz 1	170	279	187	429	79	354
Wennop	176	260				
Yellow Jersey	92	171				
Yellow Spanish	48	140				
36	74	122	71	136	73	129
127	83	122	118	189	101	156
194	156	208	57	103	107	156
97359			92	231		
021745	173	228	168	241	171	235
029378	168	274	152	324	160	299
029880	193	258	161	286	177	272
Mean	123	193	133	245	128	219
Difference required for significance	39	57	41	61	42	41

[1] For 15 sorts tested both years.

Study of the data in table 4 reveals that the 4-test means of U. S. No. 1 roots of Nancy Hall, Japanese Yam, Oebi Saboelan, and Kioranda Dutch Yellow were significantly higher than those of Porto Rico. The last two varieties significantly exceeded Porto Rico in the 4-test total means, and Kioranda Dutch Yellow significantly exceeded the Porto Rico yields in three of the four individual tests. Unfortunately Kioranda Dutch Yellow is not quite so attractive in appearance as present markets desire.

In table 5 data are presented for a group of 23 sorts tested at Beltsville one or more times during the period 1936–38. The table shows Red Bermuda to be the only variety that in all 3 years yielded significantly higher than the mean of all sorts. In 1936 Red Brazil, 85984, and 85991, in 1937 Vineland Bush and 24171, and in 1938 Wenholz 2 and Wennop also gave significantly higher yields in both grades than the corresponding means for the years. Low-yielding sorts in this test included Black Spanish, St. Lucia, 312, and 97359. Mameyita and Porto Rico also tended to give relatively low yields in these trials among the particular sorts with which they were compared.

Yields in 1937 at Beltsville, Md., of 16 introductions and seedlings, when compared with Porto Rico and Vineland Bush, are shown in table 6. In this table it will be noted that 029881, B–18, and B–33 yielded significantly more than the mean of all sorts in the test in one or both grade classes; 029881 and B–33 also yielded more than Vineland Bush. The yields of Porto Rico, 10412, 47444, and 254 were poor in this test.

A number of seedlings and introductions were compared with standard varieties in the 1938 Beltsville test for which data are presented also in table 6. Porto Rico, Vineland Bush, Virovsky, and the seedling B–8 yielded significantly better than the mean of all sorts in the test. B–10, B–24, B–51, and B–69 gave low yields. No sort produced a significantly larger yield than Porto Rico in this test.

Results of yield tests of 21 sorts at Beltsville in 1937 and 1938 are presented in table 7. Nancy Hall, Pierson, Wenholz 1, 021745, and 029880 produced significantly higher yields of No. 1 grade, and Big Wig, N. Y. B. G.–1, and 36 produced significantly lower yields than the 2-year mean of all sorts included in both years. The same was true for total yields except that Porto Rico and 029878 appeared high in total yield, 127 and 194 were below average, and 021745 was about average.

A study of the mean total yields of table 8, summarizing the 5-year results at Beltsville, Md., together with the results already presented, shows that while certain varieties had significantly high yields in certain years (tables 4 to 7) this superiority was not evident in all years. Indeed with the variety Porto Rico the yield was significantly high in one test, but significantly low in two others. However, most of the varieties having superior yields in 1 or more years also equaled or exceeded the means of the respective tests in the other years. The tables indicate that the best-yielding sorts at Beltsville include: Pierson, Red Bermuda, Wenholz 1, Virovsky, 029878, Wennop, 029880, Red Brazil, and Kioranda Dutch Yellow (85986). In the tests Big Wig, Black Spanish, N. Y. B. G.–1, 254, 291, 312, Key West, Menes Moeder (47442), and 10412 appeared rather definitely inferior in yield, while the other sorts tested lay between these two extremes. (For further consideration of the superiority of certain of the sorts at Beltsville, see discussion of tables 13 and 14 on pp. 23–25.)

TABLE 8.—*Mean total yields per acre of certain sweetpotato sorts, Beltsville, Md., 1934–38*

[Means based on all tests in each year, which were not the same for all varieties]

Sort	1934	1935	1936	1937	1938	Mean
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Big-Stem Jersey	198	323	208		305	259
Big Wig				74	95	84
Black Rock				176	259	218
Black Spanish			208	123	188	173
Director			266		193	230
Florida (white)	195		251	197	274	229
Japanese Yam (22437)	229	279	193			234
Key West	229	186	48			154
Kioranda Dutch Yellow (85986)	306	339	213	146		251
Mameyita	222	268	122	113	190	183
Menes Moeder (47442)	194	248	191	154	259	209
Myers Early			241	181	216	213
Nancy Hall	285	264	223	189	272	247
Norton			262	161	280	234
Oebi Saboelan (64377)	258	302	205			255
Pierson			320	365	447	377
Porto Rico	234	290	171	144	266	221
Red Bermuda			390	317	310	339
Red Brazil			358	180	272	270
Southern Queen	188	269	182			213
Triumph	171				175	173
Vineland Bush	226	239	233	189	218	221
Virovsky				374	293	334
Wenholz 1				279	429	354
Wenholz 2			234	175	311	240
Wennop			267	260	317	281
Yellow Jersey	211	278	215	193	146	209
Yellow Strasburg			292	134	232	219
021745			272	228	241	247
029878				274	324	299
029880				258	286	272
029881				210		
254	213	200	208	87		177
291	166	129			104	133
312	163	143	231	105		161
10412	213		158	62		144
24171			274	220	230	241
47443			219			
85984			386	146	187	239
85985			289			
85991			402			
97359			159		233	196
B-8				197	287	242
B-10				119	82	101
B-18				250	185	218
B-22				126	211	169
B-24				147	133	140
B-25					194	
B-27					187	
B-33				339	211	275
B-38				186	200	193
B-43					65	
B-51				129	129	129
B-52				98	214	156
Mean	217	250	240	187	230	

TESTS AT FLORENCE, S. C.

Mean yields for the individual years and for the combined results of 18 sorts tested each year from 1936 to 1939 at Florence, S. C., are shown in table 9. Vineland Bush, Yellow Jersey, and 24171 were significantly high yielders of both U. S. No. 1 and total roots in 2 or more years and in the mean yields for the four tests. No sort produced a significantly low yield of No. 1 grade potatoes in more than a single test, but Key West, Yellow Strasburg, S–312, Japanese Yam, Oebi Saboelan, and Kioranda Dutch Yellow gave significantly inferior total yields in 2 or more years and in the mean total yields for the 4 years. The relative total yields at Florence were not entirely in accord with those obtained at Beltsville, but it must be remembered that the sorts included in the tests were not exactly the same at the two locations. It is particularly noticeable that Kioranda Dutch Yellow was low in total yield at Florence, whereas in certain tests at Beltsville (table 4) its yield was high. Japanese Yam and Oebi Saboelan were also somewhat above the average at Beltsville. The low yields obtained with Key West were similar to those found at Beltsville, whereas Porto Rico was average in both U. S. No. 1 and total yields.

Table 9.—*Mean U. S. No. 1 grade and total yields per acre of 18 sweetpotato sorts, Florence, S. C., 1936–39*

[Means of sextuplicate plots]

Sort	1936		1937		1938		1939		Mean	
	No. 1	Total	No. 1	Total	No. 1	Total	No. 1	Total	No. 1	Total
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Big-Stem Jersey	197	328	336	678	118	173	[1] 93	[1] 185	[2] 186	[2] 341
Japanese Yam (22437)	121	187	259	497	100	138	69	122	137	236
Key West	99	152	286	204	92	134	67	124	136	154
Kioranda Dutch Yellow (85986)	138	174	239	486	103	139	65	123	136	231
Mameyita	126	166	259	550	106	151	75	132	142	250
Menes Moeder (47442)	137	206	278	587	125	181	75	141	154	279
Nancy Hall	168	244	244	523	109	156	79	138	150	265
Norton	159	210	290	549	105	172	87	155	160	272
Oebi Saboelan (64377)	106	154	268	518	109	167	69	129	138	242
Porto Rico	133	191	297	578	131	199	87	156	162	281
Unit I Porto Rico	------	------	304	619	130	191	87	162	[2] 173	[2] 324
Unit II Porto Rico	------	------	257	549	126	183	80	155	[2] 154	[2] 296
Vineland Bush	211	338	343	687	114	162	72	154	185	335
Yellow Jersey	234	382	349	717	108	152	84	155	194	352
Yellow Strasburg	105	139	267	503	108	152	71	128	138	231
021745	175	219	313	590	113	166	103	169	176	286
S–312	97	151	270	567	109	139	67	123	136	245
24171	150	249	364	751	143	214	104	164	190	345
Mean	147	218	290	583	115	166	79	146	158	278
Difference required for significance	52	24	25	34	16	39	18	20	23	29

[1] Identity of variety questionable in 1939.
[2] Not included in general mean.

Tests at Laurel, Miss.

Mean total yields for the sorts tested each year from 1935 to 1939 at Laurel, Miss., are given in table 10. Analyses of variance for each of the years showed that differences among varieties were highly significant with reference to error in all years except 1938.

TABLE 10.—*Mean total yields per acre of certain sweetpotato sorts, Laurel, Miss., 1935–39*

[Means of quintuplicate plots, 1935–38; and of sextuplicate, 1939]

Sort	1935	1936	1937	1938	1939	Mean
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Florida (white)		207	188	175	155	181
Japanese Yam (22437)	45	151				98
Key West	55	179				117
Kioranda Dutch Yellow (85986)	55	216	240	112		156
Mameyita	64	213	212	238	214	188
Menes Moeder (47442)	52	198				125
Nancy Hall	94	272	261	194		205
Norton		270	247	140		219
Oebi Saboelan (64377)	51	259	216	119		161
Pierson		293	293	144	280	253
Porto Blanco	83	182	149	164		145
Porto Orado	80	237				159
Porto Rico	84	244	219	228	268	209
Purple Stem Triumph	247	308	258	265	222	260
Red Brazil	136	271	242	134		196
Southern Queen		212	202	215	349	245
Sukhum					96	
Triumph	238	276	298	276	220	262
Unit I Porto Rico					263	
Vineland Bush	52	164				108
Wennop		303	272	261	224	265
West India	32	158				95
White Spanish	80					
Yellow Strasburg		237	226	143		202
029878					185	
029881				267	207	237
254	45	143				94
291	45	218				132
312	59	178				119
S–312	38	196	161	80		119
10412	50	186	187	79		126
47444					168	
85984	76	280	349	195	88	198
85985		274	376	191	111	238
97359		154				
B–15			294		252	273
B–22			237		108	191
B–24			158			
B–25			223	147		185
B–27			244	268	212	241
B–30					207	
B–33			355	348	229	311
B–38			246		182	214
B–40			204	158	109	157
B–41					167	
B–43			230	286	69	195
B–51					158	
B–52			333	274	252	286
B–53			171	173	147	164
B–73					152	
B–103					206	
B–153					218	
Mean	80	223	235	195	199	
Difference required for significance	35	72	34	(1)	86	

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(1) Variations due to sorts not statistically significant.

The following sorts were observed to have yielded significantly higher than the mean of all varieties in at least 1 year: Purple Stem Triumph, Triumph, Pierson, Red Brazil, Southern Queen, Wennop, 85984, 85985, B–15, B–33, and B–52. With the exception of 85984 and 85985, which were significantly low in 1939, these varieties also had yields somewhat higher than the means in most of the other years tested. Florida (white), Porto Blanco, Sukhum, West India, 254, 291, S–312, 10412, Japanese Yam, B–22, B–24, B–40, B–43, and B–53 yielded significantly low in 1 or more years, and in most of the other years yielded somewhat below the respective test means.

Again, as at Florence, S. C., and in contrast with the Beltsville results, it will be noted that the yields for Japanese Yam, Oebi

Saboelan, and Kioranda Dutch Yellow were either significantly low or somewhat lower than the yearly means. Triumph has usually been a high yielding variety at Laurel, but at Beltsville only average or somewhat below in yield. Such differences in performance indicate definite regional adaptability of certain varieties.

Tests at Stoneville, Miss.

Results of a 2-year yield test including 22 sorts at Stoneville, Miss., are given in table 11.

In 1938 Key West, Porto Blanco, Porto Rico, Triumph, Unit I Porto Rico, Wennop, and B–52 were significantly high yielding varieties, whereas Florida (yellow), Pierson, Red Brazil, Yellow Strasburg, S–312, 85984, and 85985 yielded significantly below the mean of all varieties in the test. Key West, Porto Blanco, Porto Rico, and S–312 were high yielding in 1939, and Red Jersey, Yellow Jersey, and 85985 were significantly low in yield. In the combined results for the 2 years only Porto Rico showed significant superiority over the average of all varieties. However, yields of Key West, Porto Blanco, Triumph, Unit I Porto Rico, Wennop, and B–52 were enough above the average in both years to suggest that they might exhibit definite superiority upon further trial. Although only 85985 was significantly inferior to the average, Florida (yellow), Red Jersey, Yellow Strasburg, and 85984 also appear to be poor yielders at Stoneville.

The relative yields at Stoneville for certain sorts do not agree entirely with those reported previously for Beltsville, Florence, and Laurel. Key West gave high yields at Stoneville and low yields at the other locations. Porto Blanco yields were only average or somewhat below at Laurel, whereas they were high at Stoneville. The extremely high interaction between sorts and years at Stoneville suggests that some accident may have occurred to certain plots, but the erratic behavior of several sorts is not explained.

Table 11.—*Mean total yields per acre of 22 sweetpotato sorts, Stoneville, Miss., 1938 and 1939*

[Means of quadruplicate plots]

Sort	1938	1939	Mean
	Bushels	*Bushels*	*Bushels*
Florida (yellow)	160	146	153
Key West	476	544	510
Myers Early	241	279	260
Nancy Hall	273	245	259
Norton	263	212	238
Pierson	135	360	248
Porto Blanco	428	549	489
Porto Orado	366	266	316
Porto Rico	442	585	514
Purple Stem Triumph	356	273	315
Red Brazil	104	257	181
Red Jersey	274	73	174
Southern Queen	358	284	321
Triumph	449	492	471
Unit I Porto Rico	468	413	441
Wennop	475	322	399
Yellow Jersey	329	71	200
Yellow Strasburg	182	220	201
S-312	174	589	382
85984	56	134	95
85985	57	62	60
B-52	510	416	463
Mean	299	309	304
Difference required for significance	89	203	210

Tests at Meridian, Miss.

Table 12 presents results of a replicated yield test of 25 sorts at Meridian in 1936, 1937, and 1938. Because the data were incomplete for certain replications they were not subjected to statistical analysis. Study of these data and of the results of other tests (data not presented) suggests, however, that the following sorts were high yielding in one or more tests: Florida (white), Myers Early, Nancy Hall, Porto Rico, Red Bermuda, Southern Queen, Triumph, Wennop, B–8, B–25, B–33, B–38, and B–52. Menes Moeder, Porto Blanco, Red Jersey, West India, "Y" Seedling, B–3, B–40, B–50, 10412, 029942, and 97359 appeared more or less inferior in yielding capacity in the Meridian tests.

Table 12.—*Mean marketable* [1] *and total yields per acre of 25 sweetpotato sorts, Meridian, Miss., 1936–38*

[Means of quintuplicate plots]

Sort	1936		1937		1938		Mean	
	Marketable	Total	Marketable	Total	Marketable	Total	Marketable	Total
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Big-Stem Jersey	74	101	146	210	57	80	92	130
Florida (white)	164	198	245	329	33	45	147	191
Florida (yellow)	60	81	114	188	17	23	64	97
Japanese Yam (22437)	125	155	81	127	25	40	77	107
Key West	52	80	148	228	56	76	85	128
Kioranda Dutch Yellow (85986)	144	165	164	201	43	51	117	139
Mameyita	137	156	118	225	90	114	115	165
Menes Moeder (47442)	74	95	62	132	56	86	64	104
Myers Early	134	191	311	393	141	184	195	256
Nancy Hall	136	181	185	235	84	125	135	180
Norton	128	166	166	260	32	42	109	156
Oebi Saboelan (64377)	116	133	72	117	43	64	77	105
Porto Blanco	--------	50	67	191	52	86	[2] 60	109
Porto Rico	--------	110	20	96	95	117	[2] 58	108
Purple Stem Triumph	--------	91	85	155	62	71	[2] 74	106
Red Bermuda	128	169	171	245	81	116	127	177
Red Jersey	51	89	101	157	51	90	68	112
Southern Queen	136	178	226	313	82	108	148	200
Triumph	153	197	227	306	141	174	174	226
Vineland Bush	121	159	130	193	98	140	116	164
Yellow Jersey	74	119	110	163	61	100	82	127
254	63	88	193	302	66	89	107	160
291	52	101	108	212	44	84	68	132
312	51	103	89	171	32	69	57	114
S–312	123	143	155	187	62	76	113	135
Mean	104	132	139	213	64	90	101	145

[1] U. S. No. 1 and No. 2 grades combined.
[2] For 1937 and 1938.

Combined Test Data

Tables were prepared for making comparisons of a large number of sorts included in different tests at Laurel, Miss., or at Beltsville, Md. Summarized data on total yields for certain of these comparisons designated as group tests and the corresponding variance analyses of the data are presented in table 13.

Table 13.—*Mean total yields per acre of certain sweetpotato sorts when data for certain years from Beltsville, Md., and Laurel, Miss., were combined*

EXPERIMENTAL DATA

Sort	Group test No.— 1 (Laurel, 1935–36)	2 (Laurel, 1937–38)	3 (Laurel, 1936–38)	4 (Beltsville, 1936–37)	5 (Beltsville, 1937–38)
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Florida (white)		182	190	224	236
Japanese Yam (22437)	98				
Key West	117				
Kioranda Dutch Yellow (85986)	136	176	189	180	
Mameyita	139	225	221	118	152
Menes Moeder (47442)	125			173	204
Nancy Hall	183	228	242	206	231
Norton		194	219	212	221
Oebi Saboelan (64377)	155	168	198		
Pierson		219	243	343	406
Porto Blanco	133	157	165		
Porto Orado	159				
Porto Rico	164	224	230	158	205
Purple Stem Triumph	278	262	277		
Red Brazil	204	188	216	269	226
Southern Queen		209	210		
Triumph	257	287	283		
Vineland Bush	108			211	204
Wennop		267	279	264	289
West India	95				
Yellow Strasburg		185	202	213	183
254	94			148	
291	132				
312	119			168	
S–312	117	121	146		
10412	118	133	151	110	
85984	178	272	275	265	167
85985		284	280		
B–22					169
B–24					140
B–25		185			
B–27		256			
B–33		352			275
B–38					193
B–40		181			
B–43		258			
B–52		304			156
B–53		172			
Mean	148	219	222	204	215
Difference required for significance	60	92	63	103	87

ANALYSIS OF VARIANCE[1]

Source of variation	Group test 1		Group test 2		Group test 3		Group test 4		Group test 5	
	Degrees of freedom	Variance	Degrees of freedom	Variance	Degrees of freedom	Variance	Degrees of freedom	Variance	Degrees of freedom	Variance
Between sorts	20	4, 908**	25	6, 240**	18	5, 758**	15	7, 434*	16	8, 226**
Between years	1	193, 121**	1	34, 996**	2	29, 538*	1	48, 907**	1	32, 426**
Error	20	885	25	2, 115	36	1, 463	15	2, 656	16	1, 905
Total	41	7, 536	51	4, 782	56	4, 846	31	6, 460	33	5, 895

[1] *=Significant; **=highly significant.

From the data of group tests and their variance analyses it is evident that Triumph and Purple Stem Triumph in group 1 and B–33 in group 2 yielded significantly higher than the average at Laurel, while S–312 was significantly lower in yielding capacity in groups 2 and 3 and 10412 in group 3. Although statistical significance is lacking, it also appears that Wennop, 85984, 85985, and B–52 may be rather promising in their yielding abilities at Laurel, while Key West, Vineland Bush, 254, 312, Japanese Yam, and Kioranda Dutch Yellow are of rather doubtful value.

In group tests 4 and 5 for Beltsville, the varieties Pierson, Red Brazil, Wennop, and B–33 yielded consistently above the average. Mameyita, 10412, and Menes Moeder were rather low-yielding sorts. Many other groupings for comparison brought out no other outstanding facts.

In order to ascertain which varieties or seedlings were superior in two or more locations in a single or several years, another series of group-test tables were prepared covering two or more locations in 1 or more years. Mean total yields found in certain of these group tests and analyses of variance for them are presented in table 14.

TABLE 14.—*Mean total yields per acre of certain sweetpotato sorts when data from Maryland, Mississippi, and South Carolina were combined*

EXPERIMENTAL DATA

Sort	Group test No.—						
	1 (Laurel and Beltsville, 1936)	2 (Laurel and Beltsville, 1937)	3 (Laurel and Beltsville, 1936–38)	4 (Laurel, 1935–36; Beltsville, 1934–36)	5 (Laurel and Florence, 1936–38)	6 (Laurel and Stoneville, 1939)	7 (Laurel and Meridian, 1937–38)
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Florida (white)	229	193	215				184
Japanese Yam (22437)	172			179			
Key West	114			139			
Kioranda Dutch Yellow (85986)	215	193		226	228		135
Mameyita	168	163	181	178	255	276	197
Menes Moeder (47442)	195			177			
Nancy Hall	248	225	235	228	275		204
Norton	266	204	227		265		172
Oebi Saboelan (64377)	232			215	239		129
Pierson	307	329	310			270	149
Porto Blanco							148
Porto Rico	207	182	212	205	277	427	169
Purple Stem Triumph						248	187
Red Brazil	315	211	243				125
Southern Queen	197					317	210
Triumph						356	251
Unit I Porto Rico						338	
Vineland Bush	199			183			
Wennop	285	266	280			273	230
Yellow Strasburg	265	180	211		233		125
254	176			162			
312	205			155			
S–312					216		126
10412	172	125					86
85984	332	248	257			111	178
85985	281					87	179
97359	357						
B–22		182					
B–24		153					
B–25							148
B–27							169
B–33		347				301	255
B–38		216					
B–40							122
B–52		216				334	209
Mean	224	213	237	186	248	278	170
Difference required for significance	85	105	53	48	38	161	84

TABLE 14.—*Mean total yields per acre of certain sweetpotato sorts when data from Maryland, Mississippi, and South Carolina were combined*—Continued

ANALYSIS OF VARIANCE [1]

Source of variation	Group test 1		Group test 2		Group test 3		Group test 4	
	Degrees of freedom	Variance	Degrees of freedom	Variance	Degrees of freedom	Variance	Degrees of freedom	Variance
Between sorts	21	6, 508**	16	6, 699*	9	8, 430**	10	4, 221**
Between years					2	9, 719*		
Between locations	1	69	1	47, 588*	1	1, 750		
Between tests							4	662, 080**
Sorts×years					18	2, 273		
Sorts×locations	21	[2] 1, 827	16	[2] 2, 742	9	5, 332*		
Years×locations					2	28, 403**		
Sorts×locations×years					18	[2] 2, 119		
Sorts×tests							40	[2] 1, 429
Total	43	4, 072	33	6, 019	59	4, 761	54	6, 439

Source of variation	Group test 5		Group test 6		Group test 7	
	Degrees of freedom	Variance	Degrees of freedom	Variance	Degrees of freedom	Variance
Between sorts	7	3, 105*	11	18, 631*	23	7, 463*
Between years	2	213, 341**			1	141, 527**
Between locations	1	86, 360**	1	85, 323**	1	228, 931**
Between tests						
Sorts×years	14	722			23	1, 295
Sorts×locations	7	939	11	[2] 6, 474	23	4, 283
Years×locations	2	158, 040**			1	7, 920
Sorts×locations×years	14	[2] 1, 062			23	3, 508
Sorts×tests						
Total	47	18, 774	23	15, 717	95	7, 990

[1] *=Significant; **=highly significant.
[2] "Error" variance.

The data for group tests 1 to 4, which involve trials at Laurel and Beltsville, show Pierson, Red Brazil, 85984, 97359, and B–33 to have significantly exceeded the average yield in one or more group tests, and Nancy Hall, Wennop, Oebi Saboelan, and 85985 were above average but not significantly so. In these same group tests Key West was significantly below the average yield. Group test 6 shows that the two introductions 85984 and 85985 are among the list of significantly low-yielding sorts at Laurel and Stoneville, Miss.

Among the sorts included in group test 7 for Laurel and Meridian in 1937 and 1938, only the seedling B–33 yielded significantly higher and 10412 significantly lower than the mean of all sorts in the test. Other sorts that tended to be high yielding were Triumph, Wennop, Southern Queen, B–52, Nancy Hall, and Mameyita, whereas relatively low yields in this test were found for B–40, Red Brazil, Yellow Strasburg, and S–312.

STARCH CONTENT AND YIELD

Results of starch analyses of a number of sorts, grown at Beltsville, Md., and in several locations in Mississippi in various years between 1935 and 1939, are presented in tables 15 to 18. Many sorts found to be low in starch early in this work were not analyzed in the later years.

It is apparent from even a cursory examination of these data that there are considerable variations in starch percentages within a single sort among different seasons and locations. Direct comparisons of starch percentages of different sorts are not always possible from the sort means shown in tables 15 to 18, since the same sorts were not analyzed in all seasons or locations. In order to determine, as far as possible, the extent to which certain sorts tended to be superior or inferior in starch content at Beltsville, Md., Meridian, Miss., or Laurel, Miss., regardless of seasonal differences, a number of group-test tables were prepared covering those sorts analyzed for various combinations of years at each location. These group-test data were then analyzed statistically. Mean starch percentages found for the various sorts included in certain of these group tests are set forth in table 19. The analyses of variance for these data are not presented, but they all showed significant or highly significant variances due to sorts. The analyses also showed significant or highly significant variances due to years with the exception of group tests 5 and 9. Calculated minimum values required for significance of differences between sort means listed in each column are indicated in table 19.

TABLE 15.—*Starch content and calculated yield of starch per acre of certain sweetpotato sorts, Beltsville, Md., 1935–39*

Sort	Starch content (fresh-weight basis)—						Calculated starch production per acre—				
	1935[1]	1936	1937	1938	1939	Mean	1935	1936	1937	1938	Mean
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Big-Stem Jersey	15.9	17.4		12.7		15.2	2,738	1,986		2,135	2,286
Big Wig					21.9						
Black Rock				15.9						2,271	
Director				22.3	26.3	24.3				2,364	
Florida (white)	16.2			22.1	27.2	21.8				3,330	
Formosa Seedling (1934)			19.5	17.9		18.7					
Japanese Yam (22437)	20.8	26.8	26.8	19.6	26.7	24.2	3,646	2,645			3,145
Key West	18.3	23.0	21.0		22.5	21.2	1,873	606			1,239
Kioranda Dutch Yellow (85986)	17.0	28.6	25.1	19.3	22.5	22.5	3,172	3,353	2,013		2,846
Mameyita	17.0	24.6	22.7	20.7	23.2	21.6	2,500	1,651	1,411	2,160	1,930
Maryland Golden		16.3		22.1		19.2					
Menes Moeder (47442)	18.4	21.2	19.0			19.5	2,511	2,226	1,608		2,115
Myers Early	22.9	24.1	24.4	22.1	24.1	23.5		3,197	2,428	2,625	2,750
Nancy Hall	19.4	20.2	19.8	21.6	22.1	20.6	2,817	2,473	2,062	3,237	2,647
Norton	23.1	26.0	26.6	20.7	27.5	24.8		3,748	2,355	3,183	3,095
Oebi Saboelan (64377)	20.1	27.5	22.6			23.4	3,342	3,105			3,223
Pierson	21.0	24.3	21.4	17.3	21.8	21.1		4,277	4,300	4,248	4,275
Porto Blanco					15.7						
Porto Rico	17.9	18.9	18.0	20.8	22.5	19.6	2,857	1,781	1,430	3,036	2,276
Question			20.3	22.6		21.5					
Red Bermuda			22.5	22.1	22.9	22.5			3,930	3,768	3,849
Red Brazil	21.9	24.2	23.9	22.4	25.0	23.5		4,767	2,361	3,344	3,491
St. Lucia				20.0	22.6	21.3					
Southern Queen	23.5	28.7	21.9		27.3	25.3	3,481	2,869			3,175
Triumph	21.5	28.2	19.7	22.4	27.1	23.8				2,157	
Vineland Bush	14.2	16.3		18.1		16.2	1,869	2,088			1,978
Virovsky				18.4						2,957	
Wenholz 1			19.5	15.9		17.7			2,997	3,742	3,369
Wenholz 2			25.0	21.2	22.6	23.0			2,408	3,626	3,017
Wennop			15.2	20.2	23.2	19.5			2,355	3,183	2,769
Yellow Jersey		15.8						1,862			
Yellow Strasburg	21.2	25.6	26.5	21.7	27.9	24.6		4,105	1,950	2,774	2,943
021745	21.8	20.4	19.3	18.4		20.0			2,415	2,442	2,429
029878		25.2	20.6	19.1	25.7	22.6			3,106	3,398	3,252
029879			14.6	17.3		16.0					
029880		19.9	16.8			18.3			2,381		
029881		17.7									
029942			21.1		16.6	18.8					
36					19.6						
54					21.7						
127				16.2							
194				18.4	22.5	20.5					

[1] Abnormally low values are probably the result of delayed sampling of roots improperly stored.

Table 15.—*Starch content and calculated yield of starch per acre of certain sweetpotato sorts, Beltsville, Md., 1935–39*—Continued

Sort	Starch content (fresh-weight basis)—						Calculated starch production per acre—				
	1935[1]	1936	1937	1938	1939	Mean	1935	1936	1937	1938	Mean
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
254	13.2	20.4				16.8	2,435	2,523			2,479
291	15.2										
312	12.2										
S–312	22.4				19.6	21.0					
335					15.2						
10412	20.9	26.9	22.9		24.8	23.9		2,338	781		1,559
24171			19.8	17.8		18.8			2,396	2,254	2,325
47443	12.5	12.9				12.7					
47444		22.2	17.9			20.0					
85984	10.8	11.5				11.1					
85985	12.3	15.2				13.7					
85991	10.2	13.0				11.6					
97359	17.0	19.0	14.9	15.2		16.5		1,664		1,952	1,808
B–8		19.9	12.5	18.5		17.0					
B–15			21.7								
B–22			19.8	21.8	22.1	21.2			1,369	2,532	1,950
B–25		22.1	20.4		20.9	21.2					
B–27			21.4	19.2	19.4	20.0					
B–30				20.0	21.8	20.9					
B–33		25.8	19.5	24.4	24.3	23.6			3,632	2,828	3,230
B–38		22.2	18.0	19.9	20.8	20.2			1,841	2,185	2,013
B–43			21.6		20.4	21.0					
B–52	12.0	21.2	15.3			16.2					
B–67			18.1	22.4	25.5	22.0					
B–105			19.3	21.3	21.9	20.8					
Mean	17.7	21.5	20.4	19.7	22.8		2,770	2,663	2,343	2,869	

---

[1] Abnormally low values are probably the result of delayed sampling of roots improperly stored.

Table 16.—*Starch content and calculated yield of starch per acre of certain sweetpotato sorts, Laurel, Miss., 1935–39*

Sort	Starch content (fresh-weight basis)—						Calculated starch production per acre—					
	1935	1936	1937	1938	1939	Mean	1935	1936	1937	1938	1939	Mean
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Dessert					20.9						3,138	
Florida (white)	22.1	27.8	29.0	25.3	22.8	25.4		3,254	3,269	2,655	2,124	2,826
Japanese Yam (22437)	23.8	24.9				24.3	642	2,243				1,443
Key West	23.8	24.0			22.8	23.9	786	2,581				1,683
Kioranda Dutch Yellow (85986)	24.6	27.7	30.1	27.0		27.2	811	3,486	4,329	1,814		2,610
Mameyita	22.1	22.2	25.2	22.5	19.3	22.3	847	2,834	3,205	3,213	2,474	2,515
Menes Moeder (47442)	23.0	23.2				23.1	717	2,744				1,731
Nancy Hall	25.2	22.2	29.0	24.5		25.3	1,421	3,361	4,538	2,849		3,042
Norton		26.6	27.9	26.5		27.0		4,267	4,135	2,227		3,543
Oebi Saboelan (64377)	22.9	26.2	28.8	25.5		25.9	699	4,211	3,762	1,825		2,617
Pierson		23.1	27.0	22.5	22.1	23.7		4,066	4,746	1,947	2,382	3,285
Porto Blanco	26.2	24.8	28.1	23.8		25.7	1,304	2,703	2,510	2,338		1,964
Porto Orado	23.9	21.5				22.7	1,149	3,059				2,104
Porto Rico	25.2	22.0	25.0	18.7	18.0	21.8	1,270	3,214	3,311	2,561	2,899	2,651
Purple Stem Triumph	25.2	23.6	24.5	23.0	17.4	22.7	3,734	4,357	3,789	3,663	2,334	3,575
Red Brazil	24.6	28.3	27.9	23.2		26.0	2,005	4,239	4,051	1,867		3,041
Southern Queen		25.0	28.6	26.5	16.0	24.0		3,205	3,469	3,413	2,396	3,121
Sukhum					32.3						1,858	
Triumph	24.1	24.8	25.7	23.6	22.4	24.1	3,439	4,098	4,602	3,905	2,958	3,800
Unit I Porto Rico					19.0						2,998	
Vineland Bush	20.0	21.6				20.8	623	2,076				1,350
Wennop		26.9	26.1	24.5	23.7	25.3		4,221	4,259	4,259	3,187	3,982
West India	25.0	22.9				23.9	480	2,203				1,342
White Spanish	27.5						1,318					
Yellow Strasburg		27.5	29.7	25.0		27.4		3,288	4,414	2,147		3,283
029878					21.2						2,352	
029881			25.6	18.0	19.7	21.1				2,884	2,600	2,742
254	22.1	22.1				22.1	598	1,892				1,245
291	22.5	22.7				22.6	607	2,881				1,744
312	22.1	20.1				21.1	784	2,243				1,514
S–312	25.3	26.0	26.3	26.3		26.0	577	3,058	2,538	1,216		1,847
10412	23.9	28.8	28.1	25.2		26.5	718	3,114	3,150	1,194		2,044

Table 16.—*Starch content and calculated yield of starch per acre of certain sweet-potato sorts, Laurel, Miss., 1935–39*—Continued

Sort	Starch content (fresh-weight basis)—						Calculated starch production per acre—					
	1935	1936	1937	1938	1939	Mean	1935	1936	1937	1938	1939	Mean
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
47444					23.1						2,328	
85984	17.8	20.3	20.5	18.9	16.2	18.8	810	3,405	4,297	2,211	972	2,339
85985		20.5	21.8	14.2	15.9	18.1		3,373	4,913	1,630	1,056	2,743
97359		23.3						2,154				
B-15		24.5	24.7		20.9	23.4			4,350		3,165	3,758
B-22		24.3	25.7		20.7	23.6			3,645		1,339	2.492
B-24		27.0	26.6			26.8			2,525			
B-25		26.6	24.6	27.0		26.1			3,287	2,381		2,834
B-27		26.3	25.6	21.7	17.1	22.7			3,742	3,487	2,176	3,135
B-30					20.9						2,598	
B-33		25.7	27.2	23.0	22.9	24.7			5,789	4,811	3,150	4,583
B-38		27.2	25.9		21.2	24.8			3,826		2,314	3,070
B-40		24.7	27.2	23.9	21.5	24.3			3,327	2,269	1,408	2,335
B-41					21.8						2,027	
B-43		29.5	28.1	25.7	21.5	26.2			3,875	4,417	892	3,061
B-51					18.8						1,815	
B-52		23.9	25.0	21.3	21.3	22.9			4,998	3,493	3,216	3,902
B-53		25.0	25.9	22.7	20.5	23.5			2,659	2,354	1,807	2,273
B-73					21.2						1,932	
B-103					21.6						2,490	
B-153					18.9						2,475	
Mean	23.6	24.6	26.5	23.3	20.7		1,152	3,167	3,843	2,705	2,286	

Table 17.—*Starch content and calculated yield of starch per acre of certain sweet-potato sorts, Meridan, Miss., 1935–38*

Sort	Starch content (fresh-weight basis)—					Calculated starch production per acre—			
	1935 [1]	1936 [1]	1937 [2]	1938 [2]	Mean	1936	1937	1938	Mean
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Big-Stem Jersey		20.0	20.3	22.7	20.8	1,110	2,348	999	1,486
Florida (white)	24.1	27.2	25.1	29.3	26.7	2,960	4,533	724	2,739
Florida (yellow)	21.4	25.2	21.5	20.9	23.7	1,123	2,218	264	1,202
Japanese Yam (22437)	22.4	23.9	24.0	26.5	24.1	2,041	1,673	583	1,432
Jersey Yam		22.3		22.6	22.4	921		967	944
Key West	17.7	23.8	21.3	21.7	22.0	1,045	2,672	907	1,541
Kioranda Dutch Yellow (85986)	20.7	25.5	24.7	27.7	24.7	2,311	1,995	625	1,644
Mameyita	22.9	21.6	20.4	22.6	21.6	1,853	2,525	1,416	1,931
Menes Moeder (47442)	20.9	23.6	20.5	24.3	22.6	1,232	1,490	1,147	1,290
Myers Early		25.6	25.0	24.2	24.9	2,685	5,408	2,451	3,515
Nancy Hall	24.7	27.7	25.1	26.0	26.5	2,760	3,248	1,789	2,599
Norton		26.6	26.0	27.9	26.8	2,432	3,712	643	2,262
Oebi Saboelan (64377)	21.1	27.2	19.8	25.8	24.7	1,988	1,274	907	1,390
Pierson		26.1		22.6	24.4	1,436		1,086	1,261
Porto Blanco		27.4		23.5	25.4	752		1,112	932
Porto Rico		22.5	20.4	22.3	21.9	1,361	1,525	1,142	1,343
Purple Stem Triumph		25.0				1,252			
Red Bermuda		24.3	17.4	22.0	21.2	2,259	2,345	1,404	2,003
Red Brazil		27.0		19.6	23.3	1,351		669	1,010
Red Jersey		22.7	19.3	20.5	21.3	1,110	1,663	1,013	1,262
Southern Queen		27.0	23.6	24.9	25.6	2,643	4,064	1,480	2,729
Triumph		23.6	23.4	22.0	23.1	2,555	3,816	1,596	2,656
Vineland Bush	17.7	20.2	17.8	21.3	19.5	1,763	1,894	1,640	1,766
Wennop		26.7		21.2	23.9	2,711		1,317	2,014
West India		27.5		26.9	27.2	333		370	352
Yellow Jersey		19.1	19.3	24.0	20.8	1,249	1,728	1,322	1,433
Yellow Seedling		20.2		19.4	19.8				
Yellow Strasburg		27.0		27.0	27.0	906		802	854
029879		20.3		17.6	19.0	1,689		222	956
029942		25.4		21.3	23.3	600		398	499
254	17.1	24.1	18.6	20.5	21.4	1,167	3,091	1,001	1,753
291	16.6	21.6	29.5	22.6	22.2	1,200	3,440	1,042	1,894
312	19.2	23.8	18.7	19.9	21.5	1,346	1,757	757	1,287
S-312	22.7	25.2	25.0	28.8	25.3	1,982	2,572	1,202	1,919
10412		22.0		25.7	23.9	495		311	403
85984		20.7		15.5	18.1	751		604	678
85985		18.0		17.4	17.7	455		699	577
97359		22.1		25.7	23.9	682		452	567

Table 17.—*Starch content and calculated yield of starch per acre of certain sweetpotato sorts, Meridian, Miss., 1935–38*—Continued

Sort	Starch content (fresh-weight basis)—					Calculated starch production per acre—			
	1935 [1]	1936 [1]	1937 [2]	1938 [2]	Mean	1936	1937	1938	Mean
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
B-3		19.4		17.9	18.7	642		404	523
B-6		17.6		17.2	17.4	776		463	620
B-8		20.3		18.0	19.2	1,242		1,002	1,122
B-15		25.4		20.3	22.9	1,633		580	1,107
B-22		23.8		22.3	23.0	1,045		920	983
B-24		24.1		22.3	23.2	584		245	415
B-25		25.0		24.7	24.9	2,986		733	1,860
B-27		24.3		21.9	23.1	1,016		674	890
B-33		25.9		22.2	24.1	2,865		1,037	1,951
B-38		20.7				1,139			
B-40		22.1		21.6	21.9	706		522	614
B-50		21.6		19.2	20.4	570		497	534
B-52		23.0		20.6	21.8	1,774		566	1,170
B-55		22.7		23.5	23.1	1,023		593	808
Mean	20.6	23.6	22.0	22.5		1,461	2,642	909	

[1] Determinations made on fresh material by the polariscopic method developed at the Laurel Starch Plant, Laurel, Miss.

[2] Samples preserved in alcohol and analyzed by the difference method.

Table 18.—*Starch content of certain sweetpotato sorts, Poplarville, State College, and Stoneville, Miss.*

[Percent of fresh weight]

Sort	Stoneville		State College, 1939	Poplarville, 1939
	1938	1939		
	Percent	*Percent*	*Percent*	*Percent*
Florida (white)			18.8	
Florida (yellow)	18.5			
Japanese Yam (22437)				
Key West	20.5	19.9		
Kioranda Dutch Yellow (85986)		16.7	20.4	28.9
Mameyita		16.6	22.3	23.7
Menes Moeder (47442)				
Myers Early	24.1	17.7		
Nancy Hall	23.9	20.8	21.1	
Norton	23.4	18.5	24.1	
Oebi Saboelan (64377)			21.4	
Pierson	19.8	17.4	21.5	27.2
Porto Blanco	16.9	18.0	20.1	
Porto Orado	19.6			
Porto Rico	19.3		21.1	
Purple Stem Triumph	19.4	18.7	22.1	23.1
Red Brazil	16.4	19.9	21.1	
Red Jersey	20.2			
Southern Queen	23.6	18.3	22.1	28.0
Sukhum			30.2	
Triumph	24.3	16.4	23.3	
Unit I Porto Rico	20.7	16.7	18.3	
Virovsky			23.5	
Wennop	18.9	16.9	22.5	25.5
Yellow Jersey	16.0	18.8		
Yellow Strasburg	24.3			
029878			22.3	
312	23.9	18.7	24.8	
10412			24.3	
47444			24.8	
85984	12.6			18.9
85985	12.4			
B-15			19.6	
B-22			18.7	
B-27			17.3	
B-30			19.0	
B-33		18.1		25.8
B-38			19.3	
B-52	17.3	18.1	20.5	25.6
B-53			20.8	
B-105			21.7	
Mean	19.8	18.1	21.6	25.2

TABLE 19.—*Mean starch content of certain sweetpotato sorts when data from Beltsville, Md., and Laurel and Meridian, Miss., were combined for years but analyzed for locations separately*

[Percent of fresh weight]

Sort	Group test No.—								
	1 (Beltsville, 1935–36)	2 (Beltsville, 1936–37)	3 (Beltsville, 1936–38)	4 (Beltsville, 1935–39)	5 (Laurel, 1935–36)	6 (Laurel, 1936–38)	7 (Laurel, 1937–39)	8 (Meridian, 1935–38)	9 (Meridian, 1936 and 1938)
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Big-Stem Jersey	16.4								21.3
Florida (white)					24.9	27.4	25.7	26.7	28.2
Florida (yellow)								23.7	23.0
Japanese Yam (22437)	23.8	26.8	24.4	24.2	24.3			24.1	25.2
Jersey Yam					22.7				22.4
Key West	20.6	22.0			23.9			22.0	22.7
Kioranda Dutch Yellow (85986)	22.8	26.9	24.3	22.5	25.8	28.1		24.7	26.6
Mameyita	20.8	23.7	22.7	21.6	22.1	23.3	22.3	21.6	22.1
Myers Early	23.5	24.3	23.5	23.5					24.9
Menes Moeder (47442)	19.8	20.1			23.1			22.6	23.9
Nancy Hall	19.8	20.0	20.6	20.6	23.7	25.2		26.5	26.9
Norton	24.6	26.3	24.4	24.8		27.0			27.2
Oebi Saboelan (64377)	23.8	25.1			24.5	26.9		24.7	26.5
Pierson	22.6	22.9	21.0	21.1		24.2	23.9		24.4
Porto Blanco					25.5	25.5			25.4
Porto Rico	18.4	18.5	19.3	19.6	23.6	21.9	20.6		22.4
Purple Stem Triumph						23.7	21.6		
Red Bermuda									23.2
Red Brazil	23.0	24.0	23.5	23.5	26.4	26.5			23.3
Red Jersey									21.6
Southern Queen	26.1	25.3				26.7	23.7		26.0
Triumph	24.8	23.9	23.4	23.8	24.5	24.7	23.9		22.8
Vineland Bush	15.3				20.8			19.5	20.8
Wennop						25.8	24.8		24.0
West India					23.9				27.2
Yellow Jersey									21.6
Yellow Strasburg	23.4	26.0	24.6	24.6		27.4			27.0
021745	21.1	19.9	19.4						
029878		22.9	21.6						
029880		18.3							
029881							21.1		
254	16.8				22.1			21.4	22.3
291					22.6			22.2	22.1
312					21.1			21.5	21.9
S–312					25.7	26.2		25.3	27.0
10412	23.9	24.9			27.1	27.4			23.9
47443	12.7								
47444		20.0							
85984	11.1				19.1	19.9	18.5		18.1
85985	13.7					18.8	17.3		17.7
85991	11.6								
97359	18.0	17.0	16.4						23.9
B–8		16.2	17.0						19.7
B–25		21.3				26.1			24.9
B–27						24.5	21.5		23.1
B–33		22.7	23.3			25.3			24.1
B–38		20.1	20.0						
B–40						25.3	24.2		21.9
B–43						27.8	25.1		
B–52	16.6	18.3				23.4	22.5		21.8
B–53						24.5	23.0		
Mean	19.8	21.2	21.7	22.7	23.7	25.1	22.5	22.8	23.6
Difference required for significance	4.4	3.7	3.8	2.6	3.4	2.3	2.9	3.0	4.0

Group tests 1 to 4 for Beltsville show the following sorts to have been significantly higher than the group-test mean in one or more instances: Norton, Southern Queen, Triumph, Yellow Strasburg, 10412, Japanese Yam, Oebi Saboelan, and Kioranda Dutch Yellow. Other sorts that had high starch contents, although not significantly superior to the means for the various group tests, include Myers Early, Red Brazil, 029878, and B–33. Porto Rico, Vineland Bush, 47443, 85984, 85985, 85991, 97359, and B–8 were sorts that showed, in one or more group tests, starch percentages significantly below the means of the respective tests.

Group tests 5 to 7 for Laurel, Miss., show the starch percentages of Florida (white), Yellow Strasburg, Kioranda Dutch Yellow, and B–43 to exceed significantly their respective group-test means one or more times. Norton, Pierson, Porto Blanco, Red Brazil, Southern Queen, Triumph, Wennop, S–312, Oebi Saboelan, B–25, and B–40 also had relatively high but not significantly superior starch contents. Porto Rico, 85984, and 85985 were definitely inferior in starch percentages. The limited data for Sukhum, White Spanish, and B–24 given in table 16, but omitted from the group tests of table 19, suggest that these varieties also were high in starch content.

The data given in group tests 8 and 9 show the following sorts to have had high starch percentages at Meridian, Miss.: Florida (white), Japanese Yam, Kioranda Dutch Yellow, Myers Early, Nancy Hall, Norton, Oebi Saboelan, Porto Blanco, Southern Queen, West India, Yellow Strasburg, S–312, and B–25. Big-Stem Jersey, Red Jersey, Vineland Bush, Yellow Jersey, 85984, 85985, and B–8 were low in starch content in these tests.

At the various Mississippi locations other than Laurel and Meridian the data of table 18 show that sorts having relatively high starch percentages were as follows: At Stoneville, Myers Early, Nancy Hall, Norton, Southern Queen, Triumph, Yellow Strasburg, and 312; at State College, Norton, Sukhum, Triumph, Virovsky, 312, 10412, and 47444; at Poplarville, Pierson, Southern Queen, Wennop, Kioranda Dutch Yellow, B–33, and B–52.

Although certain sorts tended to have high starch percentages in all tests, the relative performance of some sorts differed appreciably among the several locations. As a means of ascertaining which sorts were high in starch in more than a single location in 1 or more years, a series of group-test tables for locations were prepared and analyzed. Some of these are summarized and corresponding analyses of variance are presented in table 20.

TABLE 20.—*Mean starch content of certain sweetpotato sorts when data from Maryland and Mississippi were combined for certain locations and tests*

[Percent of fresh weight]

EXPERIMENTAL DATA

Sort	Group test No.—						
	1 (Laurel and/or State College, 1939)	2 (Laurel and Beltsville, 1935–36)	3 (Laurel, 1935–36; Beltsville, 1936)	4 (Laurel, Beltsville, and Meridian, 1935–36)	5 (Laurel, 1936–38; Stoneville, 1938)	6 (Laurel and Beltsville, 1936–38)	7 (Laurel, 1936–38; Beltsville, 1935–38; Meridian and Stoneville, 1938)
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Dessert	19.9						
Florida (white)			22.0				
Japanese Yam (22437)		24.1	23.2	23.8			
Key West		22.3	22.1	21.8			
Kioranda Dutch Yellow (85986)		24.3	22.9	23.9		26.2	
Mameyita	20.8	21.5	20.4	21.7		23.0	
Menes Moeder (47442)		21.5	21.5	21.7			
Nancy Hall		21.7	22.2	23.2	24.9	22.9	23.0
Norton					26.1	25.7	25.4
Ocbi Saboclan (64377)		24.2	23.1	24.2			
Pierson	21.8				23.1	22.6	22.2
Porto Blanco					23.4		
Porto Rico	19.6	21.0	21.7		21.2	20.6	20.3
Purple Stem Triumph	19.7				22.6		
Red Brazil		24.7	24.9		23.9	25.0	23.1
Southern Queen	19.1				25.9		
Sukhum	31.3						
Triumph	22.9	24.7	23.5		24.6	24.1	23.6
Unit I Porto Rico	18.7						
Vineland Bush		18.0	18.6	18.3			
Wennop	23.1				24.1		
Yellow Strasburg					26.6	26.0	25.4
029878	21.8						
254		19.5	19.1	19.9			
291			20.1				
312			18.1				
S-312			24.6		25.6		
10412		25.2	24.6				
47444	23.9						
85984		15.1	16.3		18.1		

85985					17.2		
B-15	20.3						
B-22	19.7						
B-27	17.2						
B-30	20.0						
B-33						24.3	
B-38	20.2						
B-41	20.7						
B-51	19.9						
B-52	20.9				21.9		
B-53	20.7						
B-153	18.4						
Mean	20.9	22.0	21.6	22.0	23.3	24.0	23.3
Difference required for significance	3.3	2.3	2.8	1.8	2.6	2.4	2.0

ANALYSIS OF VARIANCE [1]

Source of variation	Group test 1		Group test 2		Group test 3		Group test 4		Group test 5		Group test 6		Group test 7	
	Degrees of freedom	Variance	Degrees of freedom	Variance	Degrees of freedom	Variance	Degrees of freedom	Variance	Degrees of freedom	Variance	Degrees of freedom	Variance	Degrees of freedom	Variance
Between sorts	21	15.49**	13	33.99**	17	17.27**	8	23.53**	14	30.66**	9	19.13**	6	28.85**
Between locations	1	.69	1	147.06**			2	41.41**			1	107.04**		
Between tests					2	217.86**			3	111.82**			8	31.63**
Between years			1	119.87**			1	146.65**			2	40.36**		
Sorts × locations	21	[2] 2.77	13	5.12			16	3.84			9	1.97		
Sorts × years			13	5.30			8	5.67			18	3.67		
Sorts × tests					34	[2] 2.93			42	[2] 3.41			48	[2] 4.27
Locations × years			1	48.30**			2	26.99**			2	29.30*		
Sorts × locations × years			13	[2] 2.66			16	[2] 2.55			18	[2] 4.38		
Total	43	8.94	55	16.86	53	15.64	53	11.68	59	15.39	59	9.85	62	10.18

[1] *=Significant; **=highly significant.

[2] "Error" variance.

Highly significant sort differences in starch content are indicated in table 20 for every group test. Among those tests comparing locations, only groups 2, 4, and 6, involving Beltsville, Laurel, and Meridian, showed location variances that were statistically significant. Significant or highly significant variances due to years and to the interaction of years and locations are also indicated by analyses for group tests 2, 4, and 6. Since neither the variances for years nor those for locations are significant when compared with the variances for the interactions between years and locations, it is concluded that in these studies no one location was best every year and that no one season was best in all locations. In the three cases in which variances for the interactions of sorts and locations or of sorts and years could be tested against the interaction of sorts, locations, and years no significance was observed. In view of the highly significant variances due to sorts these results indicate definite superiority of starch content of certain sorts over others regardless of the season or location where the comparison was made. Thus, the relative starch content of one sort compared with others seems to be fairly stable, although the actual starch content varies widely from place to place and from year to year.

Table 20 shows that the following sorts were significantly higher in starch than the test means in at least one of the group tests: Sukhum, Red Brazil, Triumph, 10412, Kioranda Dutch Yellow, S–312, Norton, Oebi Saboelan, Southern Queen, and Yellow Strasburg. Other relatively high starch sorts, although not significantly exceeding the group-test means, were Wennop, 47444, 029878, Japanese Yam, and B–33. Among sorts significantly low in starch in at least one group test were the following: B–27, Vineland Bush, 254, 85984, 85985, 312, and Porto Rico. Calculations of a large number of other groupings brought to light no additional important information.

All the Jersey-type varieties tested have been consistently low in starch content.

The percentage of starch in a variety to be utilized for industrial recovery of starch needs to be relatively high. High starch content alone, however, is not enough to make a variety satisfactory for this purpose; a satisfactory crop yield per acre is also required. In other words, the ultimately important consideration is the yield of starch that can be obtained per acre. Obviously the ideal would be a very high yielding variety with a very high starch content. In the absence of a variety having both characteristics in a very high degree, one having a moderately high starch content and a very high yield may be more desirable than one with a very high starch percentage but a low yield per acre. Of course, a variety with a definitely low starch content would be undesirable even though the yields were high, because too much raw stock would need to be processed to yield a given quantity of starch. A relatively low latex content and a minimum tendency to develop growth cracks in the roots are also highly desirable, if not absolutely essential, in a good starch variety.

Where both starch analysis and yield data were available, production of starch per acre has been calculated as total yield of roots multiplied by percentage of starch estimated chemically. Probably not over 83 to 88 percent of this calculated amount could be actually recovered. Data showing the theoretical starch yields of certain sorts grown at Beltsville, Laurel, and Meridian are presented in tables

15 to 17. Mean calculated starch yields for certain group tests for Beltsville, Meridian, and Laurel are given in table 21. Minimum requirements for significance of differences between sort means are indicated for each group test. Analyses of variance (data not presented) indicated significant or highly significant variances due to sorts in all group tests. There were no significant variances due to interactions between sorts and years or sorts and locations, indicating that certain sorts were consistently superior to others irrespective of locations or years in which grown. Highly significant variances due to locations and to the interactions between locations and years were found for group tests 5 to 7. Significant variations due to years were evident in test 5 only.

TABLE 21.—*Mean calculated yields of starch produced per acre of certain sweetpotato sorts when data from Laurel and Meridian, Miss., and Beltsville, Md., were combined for various combinations of years and locations*

Sort	Group test No.—							
	1 (Laurel, 1935–36)	2 (Laurel, 1937–39)	3 (Beltsville, 1935–36)	4 (Beltsville, 1937–38)	5 (Laurel and Beltsville, 1935–36)	6 (Laurel and Beltsville, 1936–37)	7 (Laurel and Beltsville, 1937–38)	8 (Meridian, 1936–38)
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Big-Stem Jersey								1, 486
Florida (white)		2, 683						2, 739
Japanese Yam (22437)	1, 443		3, 146		2, 294			1, 432
Key West	1, 684		1, 240		1, 462			1, 541
Kioranda Dutch Yellow (85986)	2, 149		3, 263		2, 706	3, 298		1, 644
Mameyita	1, 841	2, 964	2, 076	1, 786	1, 958	2, 275	2, 497	1, 931
Menes Moeder (47442)	1, 731		2, 369		2, 050			1, 290
Myers Early				2, 527				
Nancy Hall	2, 391		2, 645	2, 650	2, 518	3, 109	3, 172	2, 599
Norton				2, 769		3, 626	2, 975	2, 262
Oebi Saboelan (64377)	2, 455		3, 224		2, 839			1, 390
Pierson		3, 025		4, 274		4, 347	3, 810	
Porto Blanco	2, 004							
Porto Orado	2, 104							
Porto Rico	2, 242	2, 924	2, 319	2, 233	2, 281	2, 434	2, 585	1, 343
Purple Stem Triumph	4, 046	3, 262						
Red Bermuda				3, 849				2, 003
Red Brazil	3, 122			2, 853		3, 855	2, 906	
Southern Queen		3, 093	3, 175					2, 729
Triumph	3, 769	3, 822						2, 656
Vineland Bush	1, 350		1, 979		1, 664			1, 766
Wenholz 1				3, 370				
Wenholz 2				3, 017				
Wennop		3, 902		2, 847			3, 552	
West India	1, 342							
Yellow Strasburg				2, 362		3, 439	2, 821	
021745				2, 429				
029878				3, 252				
254	1, 245		2, 479		1, 862			1, 753
291	1, 744							1, 894
312	1, 514							1, 287
S–312	1, 818							1, 919
10412	1, 916					2, 346		
24171				2, 325				
85984	2, 108	2, 493						
85985		2, 533						
B–22				1, 951				
B–27		3, 135						
B–33		4, 583		3, 230			4, 240	
B–38				2, 013				
B–40		2, 359						
B–43		3, 061						
B–52		3, 902						
B–53		2, 273						
Mean	2, 096	3, 126	2, 537	2, 763	2, 163	3, 192	3, 176	1, 798
Difference required for significance	941	1, 138	743	912	559	611	778	928

From the data of table 21 and other group-test data not presented, the following sorts were found to have given starch yields significantly larger than the means of all sorts in one or more of the group tests: At Laurel, Red Brazil, Triumph, Purple Stem Triumph, and B–33; at Beltsville, Pierson and Red Bermuda; for Laurel and Beltsville together, Pierson, Red Brazil, Oebi Saboelan, and B–33; at Meridian, Florida (white), Myers Early, Nancy Hall, and Southern Queen. Other varieties that have shown good starch yields per acre in certain tests include Norton, Wenholz 1, Wenholz 2, Wennop, Yellow Strasburg, Kioranda Dutch Yellow, B–43, B–52, 029878, and Japanese Yam. Mameyita, Porto Rico, S–312, 10412, and Key West were outstandingly inferior in starch yields.

Although the data are too limited to make definite conclusions possible, Dessert, B–15, and Virovsky appeared to have given relatively high starch yields also, but Porto Blanco, Sukhum, Vineland Bush, West India, White Spanish, Yellow Jersey, 254, 291, and 97359 were low starch yielders.

Among the sorts that gave high starch yields per acre, the following also had relatively high starch percentages: Red Brazil, Triumph, B–33, Pierson, Red Bermuda, Oebi Saboelan, Norton, Southern Queen, Wenholz 2, Wennop, Yellow Strasburg, Kioranda Dutch Yellow, B–43, 029878, and Japanese Yam. These sorts appear to be worth fairly extensive testing, at least until more desirable varieties for starch production are found through further research. Of particular interest is the seedling B–33. This is the only sort tested through 1939 that has consistently given a higher acre yield of starch than the Triumph variety, which is largely used by the sweetpotato-starch industry in the Laurel, Miss., area. Although the variety Wennop possesses a relatively high starch content and gives high acre yields, its excessive content of latex is a serious drawback to its utilization in the starch factory. The very heavy exudation of latex at digging time allows considerable quantities of soil and sand to be caught in this material on the root surfaces. The foreign material so embedded can be removed from the roots only with very great difficulty, and if left on the sweetpotatoes it seriously interferes with processing.

STEM ROT, OR WILT, TESTS

Varieties or seedlings of the sweetpotato, even though they are high in starch content and commercially productive, are of limited value and adaptability if they are highly susceptible to certain diseases. This is particularly true in case they are to be grown in regions where stem rot caused by *Fusarium oxysporum* f. *batatas* is a limiting factor in crop production. There is no very effective artificial control for stem rot. The selection of disease-free bedding roots, sanitation, and crop rotation will reduce the losses but not prevent them entirely. The causal organism may persist as a saprophyte in the soil for many years, if not indefinitely, and it may become parasitic at once when it comes in contact with a susceptible variety. Fortunately, some varieties and seedlings are very highly resistant, and many others are commercially resistant or capable of producing a crop in spite of the disease. Unfortunately, on the other hand, present commercial varieties of the best quality are highly susceptible. In order to meet future requirements resistant strains of the desired type must be produced by hybridization and selection.

In order to obtain information on the stem rot susceptibility of the different sorts. greenhouse and field tests were carried out with many of those studied for starch content and yielding ability. The greenhouse tests were conducted at Beltsville, Md., by L. L. Harter and those in the field by H. T. Cook, of the Virginia Truck Experiment Station, Norfolk, Va.

The soil for the greenhouse tests was sterilized on 3 consecutive days at about 15 pounds' pressure and then was inoculated by stirring into it cultures of the causal organism about 2 weeks old grown on sterilized oats in 1- and 2-liter flasks. Several isolations from sweetpotatoes affected by stem rot were grown in separate flasks and then mixed together in the soil. Just before the plants were set in the bed, the roots were dipped into a spore suspension to insure that every plant would be exposed to infection. Southern Queen and Triumph, two varieties known to be resistant under field conditions, were included in the greenhouse trials as resistant controls. Nancy Hall and Porto Rico, two well-known, highly susceptible commercial varieties, were included as susceptible checks. The temperature of the greenhouse varied from 75° to 90° F. The first evidence of infection appeared in about 5 days after inoculation. As the plants died they were removed from the bed. The final notes were taken at the end of about 30 days when the lower parts of the stems of the plants remaining in the bed were split and examined for the presence of the disease. Five grades of susceptibility, ranging from none to very susceptible, were arbitrarily established, and the sorts were classified according to their performance. The results of the greenhouse experiments are shown in table 22.

TABLE 22.—*Reaction of different sweetpotato sorts to stem rot or wilt, when tested in the field and under controlled conditions in the greenhouse*

Immune in field	Resistant in—		Intermediate in—	
	Field	Greenhouse	Field	Greenhouse
Menes Moeder (47442).	Big Wig.	Big Wig.	Southern Queen.	Black Rock.
Red Brazil.	Japanese Yam.	Red Brazil.	Sukhum.	Menes Moeder.
St. Lucia.	Oebi Saboelan.	Virovsky.	B-52.	Pierson.
B-8.	Virovsky.	Wennop.	291.	Red Bermuda.
B-15.	B-10.	B-10.	029878.	Triumph.
B-18.	B-22.	B-15.	029880.	B-18.
B-30.	B-24.	36.	64377.	B-24.
B-33.	B-43.	254.	B-1.	B-25.
B-38.	254.	85991.	B-6.	B-27.
B-70.	312.			B-30.
B-67.	S-312.			B-38.
029879.				127.
B-73.				194.
B-103.				312.
B-105.				10412.
				85984.
				85985.

TABLE 22.—*Reaction of different sweetpotato sorts to stem rot or wilt, when tested in the field and under controlled conditions in the greenhouse*—Continued

Susceptible in—		Very susceptible in—	
Field	Greenhouse	Field	Greenhouse
Key West. B-27. B-69. 36.	Black Spanish. Key West. Maryland Golden. North Carolina No 1. Norton. N. Y. B. G. 1. Purple Stem Triumph. Unit I Porto Rico. B-40. B-70. 291. 021745. 029878. 029880. 24171. 47443. 47444. 97359.	Big-Stem Jersey. Kioranda Dutch Yellow. Little-Stem Jersey. Mameyita. Maryland Golden. Myers Early. Nancy Hall. Porto Rico. B-51. 029881.	Big-Stem Jersey. Director. Florida (white). Japanese Yam. Kioranda Dutch Yellow. Mameyita. Myers Early. Nancy Hall. Oebi Saboelan. Porto Blanco. Porto Rico. Red Jersey. St. Lucia. Southern Queen. Sukhum. Vineland Bush. Wenholz 1. Wenholz 2. Yellow Jersey. Yellow Spanish. B-8. B-41. B-43. B-51. B-52. B-53. S-312. 029881.

The field tests were conducted at Onley, Va., in a field in which sweetpotatoes had been grown for many years and which had given a high percentage of infection of susceptible varieties. Notes were taken on relative susceptibility at frequent intervals during the summer and when the sweetpotatoes were dug at the end of the growing season. On the basis of these data the sorts were classified (table 22) in the same way as those that were tested in the greenhouse.

The results in table 22 show that the method employed in the greenhouse was a much more severe test for susceptibility than the one in which the plants were planted in the field on infested soil. Some sorts that resisted infection in the field were readily infected when subjected to the extremely severe greenhouse test. The field tests showed a number of sorts to be free of infection, or resistant, under those conditions, but no sort was found to be immune when tested in the greenhouse. It was also found that certain commercial varieties that are known to be highly resistant under field conditions proved to be highly susceptible when the roots were dipped in a spore suspension of the causal organism and then planted in artificially infested soil. It is believed that any sorts that fell into the resistant and intermediate classes when tested by the greenhouse method would resist the disease sufficiently under field conditions to produce a normal crop.

The data in table 23 from a field test at Onley, Va., in 1936, give an idea of the relative stem rot (wilt) resistance and yielding capacity of certain sorts when grown in heavily infested soil. The sorts are arranged in the order of their resistance. It is believed the major portion of the plants dead at harvest were killed by stem rot infection. The first seven sorts in the table show a high degree of resistance. Key West is somewhat more susceptible and the remaining six varieties are extremely susceptible. The data on the number of dead plants indicate the same relative degrees of resistance of the sorts as shown by the percentage of living infected plants. One exception is that fewer plants of the variety Big-Stem Jersey appear to have been killed by the disease than was the case with the other highly susceptible sorts.

Positive conclusions in regard to the effect of stem rot on the yield cannot be drawn, as no uninfested land was available on which a comparable plot could be grown. However, it would appear that the yields of the Porto Rico, Little-Stem Jersey, Myers Early, and Mameyita varieties were probably definitely decreased by the disease, whereas the Big-Stem Jersey and Maryland Golden varieties produced fair yields in spite of being badly diseased.

Table 23.—*Mean U. S. No. 1 grade and total yield of, and infection on, 14 sweetpotato sorts grown in quadruplicate plots on wilt-infested soil at Onley, Va., 1936*

[Yields computed in bushels per acre]

Sort	Mean yield		Plants dead at harvest	Living plants infected at harvest
	No. 1	Total		
	Bushels	*Bushels*	*Percent*	*Percent*
312	200	282	4.0	0.0
S-312	278	323	4.3	.5
291	200	293	3.3	2.0
Japanese Yam (22437)	268	310	4.8	5.0
Oebi Saboelan (64377)	286	308	9.0	3.5
254	221	269	4.0	6.5
Southern Queen	275	330	12.8	5.0
Key West	202	247	19.0	11.5
Porto Rico	178	190	43.3	40.5
Little-Stem Jersey	81	111	45.5	47.5
Maryland Golden	232	261	32.8	48.5
Myers Early	177	197	36.3	50.0
Big-Stem Jersey	245	280	24.5	51.0
Mameyita	151	172	34.5	53.0
Mean	214	255		
Difference required for significance	62	67	13.3	

SUMMARY AND RECOMMENDATIONS

This circular reports the results of cooperative studies in Maryland, Virginia, South Carolina, and Mississippi on the appearance, yields, starch production, wilt resistance, market quality, and other characteristics of a considerable number of sorts (varieties, introductions, and seedlings) of sweetpotatoes.

Cooperating agencies and the locations of work were as follows: The Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, at Beltsville, Md., and Meridian, Miss.; the South Carolina Agricultural Experiment Station at Florence, S. C.; the Eastern Shore Experiment Farm of the Virginia Truck Experiment Station, at Onley, Va.; the Mississippi Agricultural Experiment Station at Laurel, State College, Stoneville, and Poplarville, Miss.; and the Agricultural Chemical Research Division, Bureau of Agricultural Chemistry and Engineering (formerly Bureau of Chemistry and Soils), at Washington, D. C., and Laurel, Miss.

Descriptions of certain plant and root characteristics, market and keeping qualities, and relative yield and starch-producing capacities of 13 well-known American sweetpotato varieties and 26 other sorts are presented in tabular form.

The following sorts produced definitely superior yields at two or more locations, although they did not always do so at all locations: Big-Stem Jersey, Nancy Hall, Pierson, Porto Rico, Red Bermuda, Southern Queen, Triumph, Vineland Bush, Wennop, Yellow Jersey, 24171, B–33, and B–52. In these trials certain varieties, such as Japanese Yam, Oebi Saboelan, Kioranda Dutch Yellow, Red Brazil, and Vineland Bush, which were exceptionally good yielding sorts at Beltsville, Md., proved to be rather low yielding in certain locations in the lower South. The reverse of this situation was also observed with a few other varieties, such as Southern Queen and Triumph. This indicates a rather definite regional adaptability among certain sweetpotato varieties, although at the same time many varieties are consistently high producers within the area included in these studies.

Chemical analyses revealed that roots of the following sorts contained high percentages of starch in most of the trials: Florida (white), Kioranda Dutch Yellow, Norton, Red Brazil, Southern Queen, Sukhum, Triumph, Yellow Strasburg, S–312, 10412, and B–43. Other sorts that had very good starch percentages in at least two locations include Japanese Yam, Myers Early, Nancy Hall, Oebi Saboelan, Pierson, Porto Blanco, Wennop, 312, B–25, and B–33.

Although a reasonably high starch percentage in a variety is important, it is even more important that a variety for starch manufacture shall produce high yields of starch per acre. Among those sorts listed herein as showing high or very good starch percentages only the following had sufficient yielding capacity to make them appear desirable for commercial starch manufacture: Japanese Yam, Kioranda Dutch Yellow, Norton, Oebi Saboelan, Pierson, Red Bermuda, Red Brazil, Southern Queen, Triumph, Wenholz 2, Wennop, Yellow Strasburg, 029878, and B–33. Within this group the most promising sort tested has been the seedling B–33. Excessive production of latex by the variety Wennop may interfere with its use for commercial starch recovery. It is suggested that investigators devote major attention to the sorts in this group until such time as more desirable varieties are discovered or developed by further research. It is noticeable that those varieties constituting most of the sweetpotatoes currently utilized for market (culinary) purposes are not found in the list of varieties that appear most promising for starch manufacture.

Determinations of stem rot, or wilt, susceptibility conducted under both field and greenhouse conditions indicate that a considerable number of the varieties and seedlings studied possess at least moderate resistance to this disease.

Although many sorts included in the study appear relatively poor as market or starch-yielding sorts, certain of them, because of outstanding resistance to stem rot infection or because of high starch percentages, may be valuable as parent stocks in breeding improved varieties.

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